SCIENTIFIC AMERICAN

PERIODICAL ROOM
RECEIVED
NOV 26 1915
UNIV. OF MICH.
LIBRARY

A NEW TYPE OF HOTCHKISS GUN EMPLOYED BY THE FRENCH—THE MACHINE-GUN AND ITS DEVELOPMENT—[See page 464.]

Vol. CXIII. No. 22
November 27, 1915

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents
$3.00 A Year

Oxy-Acetylene Welding and Cutting

Welding steel rings 1¼ by ¼ inch at a cost of 5 cents each.

Make Added Profits By This Process

Manufacturers of metal furniture, racks, window sash, automobile parts, steel tanks, boilers, machine tools, laundry equipment, surgical apparatus and many other products have simplified construction and increased efficiency and profit through oxy-acetylene welding. In some lines it has entirely displaced the rivet, resulting in higher quality at less cost.

Oxy-Acetylene welding makes added profits possible for you, by providing the best, quickest and cheapest method of metal joining.

The oxy-acetylene process is not limited to production work. It often more than pays for all needed equipment in time saved on repairs by repairing a single piece of broken or worn equipment, preventing tie-ups in production, delays and expense of replacement.

Necessary equipment is not expensive. We furnish high-grade apparatus for $60; (Canada $75); acetylene service at slight additional cost. Adaptable for oxy-acetylene cutting with the addition of special cutting apparatus. Thorough instructions are furnished free to every user of the Prest-O-Lite outfit. We will train your operators free if you desire.

Prest-O-Lite PROCESS

Employs Prest-O-Lite Dissolved Acetylene (ready-made carbide gas) in portable cylinders—backed by Prest-O-Lite Service. Used as conveniently as cylinders of oxygen. Saves large initial outlay and heavy depreciation of making crude acetylene in carbide generators. Perfectly dried, cleaned and purified—makes better welds and is cheaper to use.

The many possible uses for oxy-acetylene welding in your shops today will surprise you. Write us for engineering data on any phase of welding work you are contemplating. Oxy-acetylene literature, thoroughly illustrated, sent free.

The Prest-O-Lite Company, Inc. *The World's Largest Makers of Dissolved Acetylene*

Main Offices and Factory, 810 Speedway, Indianapolis Ind. — Canadian Office and Factory, Merritton, Ontario

53 Branches and Charging Plants

No, they are not Monkeys—

they are French soldiers. Just how their nose pieces and goggles keep out the poison gas, but let in the air, is told in the December Popular Science Monthly.

Do you want to know about the brilliant engineering feat by which they raised the F-4?

Do you want to know just how they telephone by wireless from Washington to Honolulu?

Do you want to know how stars are made?

Do you want to know why an automobile clock never will keep time?

Then, see the December

Popular Science Monthly

This fascinating magazine has 300 pictures, 300 articles, 160 pages. Everything that is new and marvelous in mechanics, invention, patents, electricity and engineering.

Special Offer—Clip the coupon, send 25 cents, and get the big December and January numbers, postpaid, or send $1.50 for a full year's subscription.

Popular Science Monthly
239 Fourth Avenue, New York

Name .....
Address .....
Send 25 cents for December and January numbers of Popular Science Monthly, 239 Fourth Avenue, New York.
S.A. 12-27-15

If you have a Family

nothing will give them a more constant, entertaining centre of common interest than a year's weekly visits of

The Youth's Companion

For 1916 it will be a continuous feast. It is the kind of reading you may be proud to give, the sort that builds. It's the MOST and the BEST, and it comes *weekly*—in just the installments that please.

Boys — Everything in it interests the boy. The Boys' Page, the live adventure Serials and Short Stories, Sports, Games, Things to Make, and every phase of outdoor and indoor life.

Girls — Special Stories, all her own. The Girls' Page, suggestions for making "pin money," Receipts, and everything from Conduct to Crochet and Candy Making.

Fathers — Strong Editorial Page, valuable comment on important questions of the day, Nature and Science, Original Humor, and the rare Stories catch him also.

Mothers — Read all, from Family Page to Doctor's Corner. Home Helps, Companion Receipts, the Stories, the Children's Page to read to little ones, and all are hers.

9 Rare Serials—250 Short Stories

The Great Serials alone would cost more than ten dollars in book form at the stores—*if they could be had.*

Thousands of new suggestions for pleasure and profit. Rare Articles, Fresh Humor, Witticisms, Games, Sports, Things for Boys and Girls to Make, "Companion Receipts." Every family field of activity is covered from conduct to cooking.

The *Most* and *Best* for $2.00, and 52 times a year—not 12

New subscribers who send this coupon (or mention the Scientific American) with $2.00, will get SA 77

The Youth's Companion
1. All remaining issues for 1915 Free.
2. The Companion Home Calendar.
3. The 52 issues for 1916.

ALL OF THE ABOVE FOR **$2.00**

Sample Copies Sent Upon Request

THE YOUTH'S COMPANION, BOSTON, MASSACHUSETTS

SEVENTY-FIRST YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIII.] NUMBER 22

NEW YORK, NOVEMBER 27, 1915

[10 CENTS A COPY $3.00 A YEAR

Flooring the Sea with Concrete

By W. J. L. Kiehl

WHILE a large portion of the nations of the world are engaged in fighting one another, Holland quietly continues its age-long struggle against its old enemy, the ocean; every new attempt of the foe to snatch a bit of Holland's hard-won soil is met with some ingenious defensive device.

Some years ago, it was discovered on the coast of the island of Schouwen (in Zeeland) that, although the dykes remained intact, the waters oozed up in the dyke-protected polders; the sea was undermining the land, and this undermining process began far out from the coast under the waters. Insidiously the water ate into the land until the dykes, having lost their foundation, toppled over in their turn, leaving the sea undisputed master of the field. It was the engineer of the Department of Waterways for Schouwen, Mr. Yonk Heer (Yonk Heer is a title of nobility) de Muralt who devised a means of defense against these inroads. He caused the sea bottom itself, where it sloped away seawards from the foot of the dyke, to be strengthened by laying over it a flooring of concrete. Such a flooring is in reality a sort of "mat" composed of blocks of concrete, each of one meter (39.37 inches) square. Every such "mat" weighs 200,000 kilograms (220 tons).

It is constructed on an incline built over the water. When the "mat" is ready an iron pontoon is drawn up just above it, and by an ingenious system of hawsers and pulleys, the "mat" of concrete is hoisted up until it rests against the bottom of the pontoon where it is fastened by means of the hawsers. A tugboat then tows off the whole affair—pontoon and "mat"—to the spot where it has to be sunk.

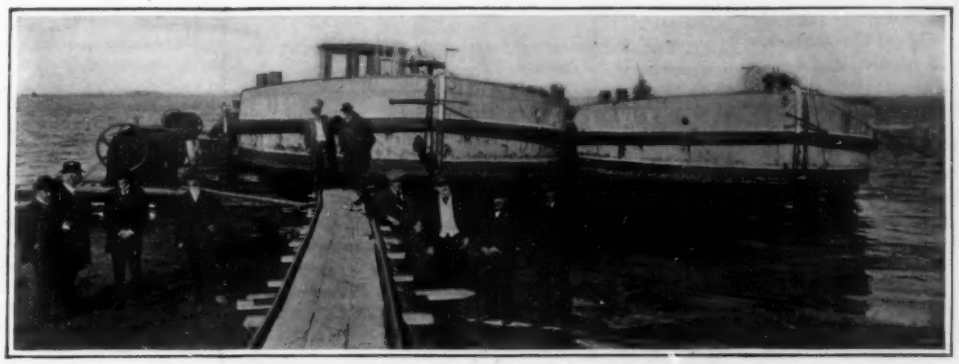
This proved so effective that the Netherlands government adopted the method for all places where the coast is menaced.

The two accompanying photographs show how this method is being applied to the "sea-defences"—the dykes and fore-shores of the southern point of the island of Texel and of den Helder in the extreme end of North Holland.

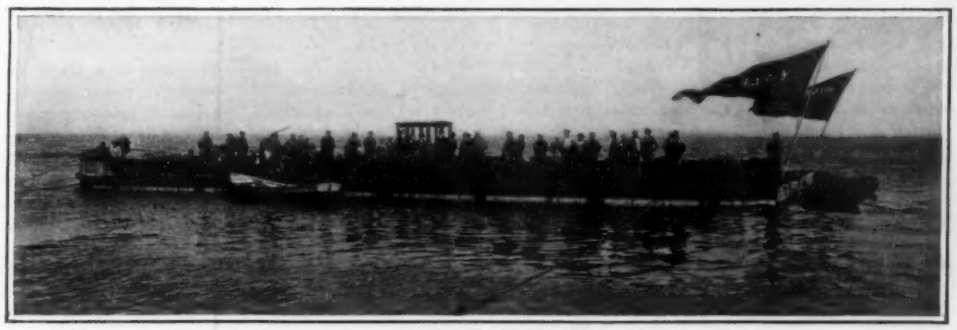
This system was adopted by the Department of Waterways to safeguard the coast of the island of Texel and the coast of North Holland near den Helder.

In one of the photographs the pontoons are seen lying over the incline in which is the concrete "mat" near Horntje on the south point of Texel.

In the other illustration the pontoons are lying at the foot of the dyke of den Helder, where the "mat" was to be sunk to the sea bottom, some 30 feet below. The figures in the photograph are those of notable engineers of the Waterways Department and members of Parliament who were present to view the proceedings.



The pontoons resting on tracks over the concrete "mat"



The pontoons lowering the concrete slab to the sea bed

Death of Theodore Berliner

A DISPATCH from Berlin by way of Rotterdam states that Theodore Berliner, the distinguished German electrician, died on November 1st, having attained his 64th year. It is stated that his death was due to overwork in directing the manufacture of war supplies.

Berliner, it will be recalled, was prominently identified with the development of the telephone, having devised a most ingenious form of carbon microphone which, although greatly modified, is employed to-day. He also devoted his efforts to the development of the phonograph, introducing the lateral-cut disk record which to-day is found in thousands of homes.

For a number of years Berliner conducted the great electrical plant in Ohlau. When the Siemens interests took charge of the Bergmann works, he was appointed director-general.

Agricultural Instruction for the Millions

IN his last annual report the Secretary of Agriculture says: "It is certain that if the average farmer could be induced to apply what the experts know or what the best farmers practice, a revolution could be brought about in the agriculture of the nation."

The most familiar milestone in the progress of agricultural education in the United States is that represented by the establishment of the "land-grant" colleges, under the provisions of the Morrill Act of 1862. By virtue of that historic enactment, every state in the Union immediately acquired at least one institution for collegiate instruction in agriculture, and the era of scientific farming was begun. The system of education thus established has been enlarged and improved by several later acts of Congress, as well as by legislation on the part of the several states. It is true, of course, that the "average farmer has, as a rule, benefited only in an indirect way by the work of the agricultural colleges, but the necessity of bringing practical instruction to farmers who were unable to attend these colleges, or even to take secondary or abridged courses in agriculture in other institutions, was long ago recognized and led to the establishment of farmers' institutes, as well as various other "extension" devices.

Another agency for the instruction of the "average farmer" has been developed by the Federal Department of Agriculture and the state institutions in the shape of elementary literature, distributed broadcast without expense, or with only trifling expense, to the recipients. Thus the Farmers' Bulletins of the United States Department of Agriculture are addressed to the "average farmer," and have been issued on a vast scale. During the 25 years ending with 1914 no less than 123,060,850 copies of these useful publications were distributed.

All in all, one might have pointed to the American farmer of a couple of years ago as an individual for whose vocational education a paternal government had done all that could be reasonably expected of it, and a little more.

Hence it is startling to learn that within the past two years the government has embarked upon new measures for educating the farmer, far more ambitious than anything ever previously attempted in this line.

Since 1913 the Department of Agriculture has had in operation an "Office of Information," the function of which is announced to be "to bring home to the 6,000,000 farm families of the Union the knowledge which the department has acquired and is increasingly acquiring." The process of furnishing free bulletins to the individual farmer in response to a separate request in each case was found to be inadequate, and accordingly the rural newspapers, agricultural and general, were pressed into service. It was found that these journals would be glad to use material if furnished to them in such a form as to be readily available, and also that correspondents of representative journals would telegraph to their home offices items giving timely information on pressing problems. Thus with the powerful aid of the newspapers, the Office of Information is imparting practical advice and instruction in agriculture on a much larger scale as well as much more promptly than was possible before this instrumentality was started.

The most striking innovation, however, in the new educational campaign is the coöperative agricultural extension scheme established a little over a year ago by the virtue of the Smith-Lever Act. This act provides for coöperation between the federal and state governments in giving personal instruction to the whole rural community. "It recognizes," says Secretary Houston, "a new class of students—a class composed of men and women working at their daily tasks on the farm." Beginning with an initial grant of $10,000 to each state, it stipulates that federal appropriations under this head shall increase by half a million dollars annually until 1921-22, and that each coöperating state shall appropriate an amount equal to the increase over $10,000. As all states have now assented to the provisions of the act, the combined federal and state appropriations for the fiscal year 1922-23 and each year thereafter will amount to $8,680,000.

Under a system carefully worked out and now in general operation, this large sum will be used each year in providing *viva voce* instruction, by competent teachers, virtually at the farmer's door.

It should be added that in this as well as other recent extension schemes of the Agricultural Department the farmer's wife has not been forgotten, as "home economics" looms large in all programmes.

Artificial Pearls

LARGE artificial pearls have been made by filling thin glass bulbs with a solution of fish scale nacre and they are very clever imitations. An easy way to detect them is to note the spot where the bulb was sealed. Liesegang has now made artificial pearls by another method. The glass bulb is coated on the inside with ten per cent gelatin solution, allowed to dry only partially and then a small amount of sodium phosphate added and the coating dried very slowly. The iridescence is an optical phenomenon caused by minute wrinkles, parallel, formed on the gelatin.

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway, New York, Saturday, November 27, 1915

Charles Allen Munn, President, Frederick C. Beach, Secretary, Orson D. Munn, Treasurer, all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Entered as Second Class Matter at the Post Office Department, Canada
Trade Mark Registered in the United States Patent Office

Copyright 1915 by Munn & Co., Inc.
Great Britain rights reserved
Illustrated articles must not be reproduced without permission

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Shall There Be a Neutral Coalition?

THE ruthless sinking of the "Ancona" and the terrible loss of life which has followed brings once more before our people the great problem of what our Government may do, not only for the protection of our own people, but in the cause of humanity, during the terrible struggle which is going on in Europe. The lull in submarine warfare since President Wilson's diplomatic correspondence with Germany, and the apparently successful issue of the demands of our Government, received a rude shock when the news of the disaster in the Mediterranean reached this country. It matters very little to our people whether the "Ancona" was destroyed by a German or an Austrian submarine. The odium which attaches to this crime is so great and the temper of our people is such that they care very little to which of the Central Powers this attack is to be attributed. The administration naturally is bound to investigate the facts in the case before taking any action in the matter. Its attitude will be necessarily guided by the legal aspects of the case as revealed by the investigation, through our foreign representatives, but in the eyes of the American people such revelations are not apt to affect the moral responsibility for such a crime.

Americans have been asking themselves whether the administration has done what it could in the cause of humanity in the struggle which is going on. Opinions in this matter differ. Many have claimed that the administration missed a golden opportunity in not entering a protest at the time of the Belgian invasion. It should be remembered, however, that this act took place so suddenly and so without warning that our people were almost stunned by the news that was received, and the proposition of entering a protest was apparently not thought of until after the time when it could with propriety have been done. Furthermore, doubtless the administration was embarrassed in this direction by its intense desire that our people should maintain an attitude of neutrality. However that may be, and whether such a protest would or would not have had any effect upon subsequent events, the question which now presents itself is, can our Government at this time take any measures which will serve to assure the conduct of the war upon more humanitarian lines than have been adhered to in the past.

In our eyes, the disasters which have occurred at sea are not as great as the horrors which may easily be apprehended through aerial raids. The loss of life through these adventures have fortunately been singularly few, but the fact that the victims have been largely peaceful civilians, including women and children, has caused them to be looked upon with special horror. The dropping of bombs upon such cities as Paris and London seems to those living in a neutral country to be particularly flagrant. These raids, so far, have only served to produce a feeling of hatred and to aid the recruiting sergeant.

No one will deny the legitimacy of such adventures in the destruction of ammunition works, railroad junctions where troops are being transported, military headquarters or other stations of war, but the effort to destroy the lives of peaceful citizens is not easily comprehended. Our people may open the morning papers almost any day to discover that some great horror has been committed against the city of London. It would be a difficult matter for our President to make a formal protest against such raids, owing to the fact that retaliation by the Allies by means of this form of warfare has already taken place. The dropping of bombs upon the neutral city of Luxemburg was not only unfortunate, but was a reprehensible act which renders the suggested protest embarrassing for our Government. The attacks upon Venice and Verona have, however, filled the civilized world with indignation, and these acts are likely to continue unless some pressure is brought to bear which the Central Powers can be made to understand.

The opportunity of protest at the time of the invasion of Belgium has long since past, but it seems to us that the time has arrived when our Government should take some distinct action, not alone for the protection of the lives of American citizens, but in the greater cause of humanity itself. It seems as if the time had come when the United States should approach the neutral nations of Europe and South America with the object of forming a coalition for the purpose of bringing every pressure to bear, short of war, upon the Central Powers to modify the method of warfare which has brought such odium upon them; to demand that the sinking of passenger steamers should stop; that senseless aerial raids upon cities, other than fortifications, should be discontinued. Such a course could not but have its effect, as showing the sentiment of the rest of the world in regard to these matters.

There are two courses which the members of such a coalition might pursue. In order to give the protest a proper seriousness should these flagrant transgressions be continued, the Red Cross work which is carried on in the countries of the Central Powers might be withdrawn. At least such a form of protest would be a new expedient, the burden of which could not well be misconstrued, and would be the first instance since the establishment of the Red Cross work in which it has been found necessary to curtail the work of lesser humanity in order to emphasize the need of a greater humanity. To be sure, it might be interposed that such a course would be construed as an act of retaliation. Such in fact it would not be, and it is certain that this expedient should not be used except as a weapon of last resort.

Another, and possibly a less objectionable, form of protest would be the agreement between these nations to break off all postal communication with the Central Powers. There is reason to believe that there are sections of Germany that are not in sympathy with the ruthless acts of the Prussian military autocrat, and it is quite certain that the better class of Germans residing in this country and those who have been here long enough to become imbued with American ideals are deeply pained over the methods that have been employed by their compatriots in the conduct of the war. Many of these try to find excuses for the wantonness of much that has been done, but in their heart of hearts they are aware that these methods of warfare have brought odium upon the German name which will not pass away for generations.

Influence of the War on Science

THE influence of science on the war has been discussed at length by several writers, but the equally interesting question of the influence of the war on science has not received much attention. At the present time scientific work is practically at a standstill throughout Europe, and that for two reasons. In the first place, a large percentage of the younger generation of scientific men are on the firing line and much of the scientific ability left behind has been diverted to purely war purposes; but the second and perhaps larger factor consists in the radical change in the psychological atmosphere of the countries at war. Without a certain calm detachment, scientific research work is impossible. In a universal atmosphere of strained expectancy, of sustained emotional tension, that necessary enthusiasm for abstract speculation seems to fade away. Even scientific men are human. And, when one comes to consider the matter, it becomes apparent that a changed mental outlook, and one unfavorable to the abstract sciences, is likely to persist after the war.

It has already been argued in these columns that governments are likely, after the war, to give science a more important place in their deliberations than they have previously accorded it. We believe this to be true, and the interesting situation arises that, while there will be a greater official encouragement of science than ever before, there will probably be fewer men devoting themselves to purely scientific work. We believe they will be engaged in other more immediately interesting and important researches. In the Victorian Age scientific research was the dominating intellectual preoccupation of Europe. Before the war it had lost something of that supreme importance. It did not bulk quite so largely in the public eye, although it is, in a manner, true to say that it had been largely replaced by one of its own children. Social reconstruction was beginning, as a theory, to assume the place that science held in the days of Huxley. And we are of the opinion that social reconstruction will be the predominant interest of Europe for some time after the war. Its problems have now become vivid and actual to everybody. More than ever it will absorb the best brains of Europe and more than ever men will turn from calculating the orbits of electrons to the calculation of minimum wages for workers. The old social system has drifted to disaster, and, although a Utopia cannot be erected on its ruins, the eager, clever young minds left after the war will find their most interesting occupation to consist in designing a reasonable social state, and will find a public unprecedentedly willing to listen to them.

No one who is familiar with Europe at the present time can fail to note, on the part of the civil population, a grim resolve that, after the war, this continual exploitation of the many by the few shall be ended forever. And, as for the men on the firing line, their experience of the uttermost realities is not likely to render them more tolerant of the sophistries of politicians. A clean-running, efficient state will be insisted upon. It will also be necessary. If Europe is to recover from its present debauch of blood and money it must practice economy of effort and the minimum of waste in every department. It is for this reason that the governments will encourage science, particularly certain sciences with great industrial applications, such as chemistry. But the type of speculative thinker who alone does first-class work in science will, we think, find a more compelling, and, in view of its greatly increased interest, a more congenial field for the exercise of his analytic and constructive gifts in social research. Sociology may cease to be a science merely in name and may be the study, above all others, which will experience great advances in the coming time.

Wireless Inventions and the Press

IT has been a matter of considerable surprise to many that the columns of the SCIENTIFIC AMERICAN have failed to contain descriptions and illustrations of several of the portable wireless receiving sets recently heralded as marvelous and revolutionizing inventions by both the daily press and a small portion of the semi-technical press. Accordingly, an explanation is due.

It is simply lack of knowledge regarding the possibilities of radio communication that causes the laity to marvel at the portable instruments that appear periodically. If the present stage of the art were fully understood—or even partially familiar to the layman—these *soi-distant* inventions would seem commonplace indeed. In most cases it would be immediately evident that they were in actuality nothing but more or less worthy replicas and modifications of instruments that have been in regular use for several years. But to appreciate fully the merits of these portable sets and the work of their designers, it is necessary to review briefly the possibilities of wireless communication.

There is nothing complicated nor truly mysterious in the reception of wireless signals. The electro-magnetic waves emitted by a radio transmitter travel in all directions at a speed of 186,300 miles per second, and have the power of creating certain effects at distant points if properly gathered and sent through appertinent apparatus. So powerful are the present-day transmitters that, given the proper apparatus, it is possible to intercept radiograms with small antennæ, such as an ordinary steel clothesline, a metal bedstead, an ordinary umbrella, any large metal object that is more or less insulated from the ground—even no antenna at all if the station sending the messages is in the immediate vicinity. As for the apparatus, it may be reduced down to a chip of mineral possessing the desirable rectifying property, on which presses a piece of copper or brass wire, forming the "detector," which is shunted by an ordinary telephone receiver. The ground connection, which is not essential but if available will permit of the use of a smaller antenna for a given strength of signal, may comprise a metal rod driven a few inches into the ground, a wire wrapped a few times around a water or gas pipe, or any object which makes good electrical contact with the earth. Could anything be simpler—or more compact?

For transmitting wireless signals over a short distance, a small induction coil and a battery will suffice. Even a common buzzer may be substituted for the induction coil, if so desired. Compactness is as readily obtained as in the receiving set.

Yet marvelous wireless "inventions" in the form of portable apparatus that may be carried in one's vest pocket and used in receiving messages sent from stations hundreds of miles distant, employing an umbrella as the antenna and a metal rod driven a few inches into the ground, continually find their way into the press. In some instances it is a beginner in the field of wireless experimentation who discovers for himself that almost any combination of odds and ends will comprise a receiving set for powerful signals, and in all good faith assumes that he has suddenly become a benefactor to mankind. But more often there is evinced a deliberate attempt by a well-versed person to secure gratuitous publicity and short-lived fame by preying upon the public's and the press's lack of technical knowledge.

Science

Substitutes for Absorbent Cotton.—Recent consular reports mention several more or less successful cheap substitutes for absorbent cotton that have been introduced since the European war began. One of these, now on sale in Berlin, is known as "lignin," and is made of pine cellulose. It is said to absorb blood better than cotton, but cannot compete with the latter as a dressing for wounds. It is, however, pronounced satisfactory for use as a second dressing. A cellulose wadding, made by a secret process from chemical wool pulp, is now offered as a dressing for wounds in Sweden. It comes in very thin sheets, resembling tissue paper. The use of sterilized sphagnum moss for the same purpose appears to have been generalized by the exigencies arising from the war.

A Plague of Locusts in Palestine.—The American consul at Jerusalem reports that the invasion of locusts from which that country has suffered this year has been the worst within the memory of the present generation. He says, "As far as the eye could reach, the fields were covered by the locusts, and even the street in front of the American Consulate had the appearance, in the movement of the green and black mass, of a flowing river." Olive groves, orchards, vineyards, market gardens, and most summer crops appear to have been completely devastated. Early in the year the Turkish authorities appointed a commission to fight the locusts, with Dr. Aaron Aaronsohn, director of the Jewish Agricultural Experiment Station, as high commissioner. An order was issued requiring every male inhabitant between the ages of 15 and 60 to collect 20 kilos (44 pounds) of locusts or pay an exemption fee of one Turkish pound ($4.40). These and other vigorous measures proved, however, to be of little avail.

The Federal Migratory Bird Law, enacted in 1918, has had, according to the Department of Agriculture, a very marked effect upon the abundance of waterfowl throughout the greater part of the country. Reports collected by the Biological Survey show increases varying, with the locality, from 10 to several hundred per cent, in such species as mallards, widgeon, sprigtails, teal, wood ducks, canvasbacks, Canada geese, and swans. Some reports state that the number of waterfowl remaining to breed exceeds anything seen during the past 10 to 25 years. The timely character of this law is shown by the fact that the number of migratory game birds now existing in the United States is only about 10 per cent of that found in the same area 75 years ago, and the total extermination of many important species was imminent. The law protects not only game birds but also insectivorous birds, and the latter are the natural enemies of insects which, according to an estimate of the Bureau of Entomology, injure agricultural products to the extent of about $652,000,000 a year.

Long-distance Shipments of Pollen.—The novel feat of shipping the pollen of citrus fruits from Washington, D. C., to Japan for use in hybridizing experiments has been recently achieved by the U. S. Bureau of Plant Industry, according to a communication from Miss M. Kellerman, published in *Science*. Although pollen had previously been shipped in cold storage from Florida to California, new methods were necessary for the longer journey, and several plans were tried. One was to place the anthers in glass tubes, from which the air was subsequently exhausted. Another was to pack them in similar tubes which, besides being exhausted of air, were dried with sulfuric acid. A large percentage of the pollen, which included that of grapefruit, tangelo, orange, etc., germinated promptly after arrival at its destination. The long-distance shipment of pollen in vacuum tubes offers a convenient substitute for the shipment of whole plants for use in breeding, in certain cases, and one which probably obviates the danger of carrying plant diseases and insect pests.

The German Meteorological Observatory in Spitsbergen, according to a news despatch from Trondhjem, Norway, has been plundered and partially destroyed by British marines, and its German staff has been taken prisoners. This observatory was founded by Prof. H. Hergesell, president of the International Commission on Scientific Aeronautics, chiefly for the purpose of making observations of the upper air with kites and balloons, and has made important contributions to arctic aerology. Some valuable work has also been done here in measuring the height of the aurora by photographic methods. Although daily telegraphic weather reports from Spitsbergen have doubtless been useful to the German army during the war, in connection with determining the general weather conditions in their bearing on Zeppelin raids and other military operations, these reports are, we believe, received from the Spitsbergen observatory of the Norwegian Meteorological Institute, and not from the German institution. The motive that prompted the British to dismantle the latter institution is, therefore, not obvious.

Automobile Notes

British Doctors Get Gasoline Rebate.— Gasoline is far more expensive in Great Britain than in the United States, and in order not to inflict a too heavy outlay on physicians using light cars in their professional work, the British government is now granting a rebate of 3d. per gallon to all doctors making application for the same before their local collector of taxes.

Hot Rag Helps Starting.— Motorists whose cars are difficult to start in cold weather should remember that a rag dipped in hot water and wrapped around the carburetor will usually cause the motor to start promptly. The reason is found in the condensation of gasoline on the carburetor walls. The hot rag helps vaporize this liquid fuel.

142,000 Tons Crude Rubber.—According to the estimates made by one of the leading rubber companies, the production of crude rubber in 1915 will reach 142,000 tons. Almost one half of this amount will be used in the United States, and half of this will be turned into rubber products at Akron, Ohio. Plantation rubber was grown in 1915 on 1,330,000 acres, producing two thirds of the world's rubber.

Epsom Salts for Light Dimming.— Five cents' worth of Epsom salts dissolved in a teacup full of water provides the neatest and most efficient "headlight dimmer" for automobiles, so far proposed. The solution is used on the inside of the headlight glass, where it is allowed to evaporate. The result is a beautifully frosted lens, the frosting on which lasts for several months.

The Day of the Multi-Cylinder Engine.—At a recent meeting of the Society of Automobile Engineers, in discussing the new eight- and twelve-cylinder engines, one member propounded the startling question, "When will some one come along with a sixteen?" He thought the limit has not been reached in the twelve, or "twin six," as it is termed, and that the steady tendency was toward the gas turbine.

Fallacious Arguments.—At a recent meeting of automobile engineers one member endeavored to demonstrate the superiority of the eight-cylinder engine over the "twin six" on the ground of volumetric efficiency. In replying to this theory another member called attention to the fact that the same argument had been used years ago, in the days of the "one-lungers," to prove that they never could be replaced by a two-cylinder engine.

Camping with a Touring Car.—Of course camping out trips with a touring car are no novelty, and many ingenious plans have been suggested for the sleeping accommodations. A recently proposed scheme is to separate the back of the front seat, and reattach it with hinges. At night this back is turned down to fill the space between the front and back seats, forming a level bed. If the length thus secured is not sufficient, cushioned boards can be fitted between the front seat and the dash.

The Question of Weight.—Although the cyclecar is practically defunct, its brief career in this country brought out one point very strongly—that a car can be built too light. Besides being difficult to properly balance, and holding the road badly, a light construction quickly affects its own destruction, for the excessive vibration of every part makes it impossible to keep joints tight, and with the loosening of joints the whole structure is soon wrecked. Of course it is easy to go to the other extreme; but the moral of the story is that too much engineering skill cannot be put into every part of an automobile to ensure stiffness and durability, without excessive and unnecessary weight.

Considering the Buyer.— It is interesting to note that at a recent meeting of automobile engineers one member suggested that more consideration should be given to the buyer. In their efforts to outdo competitors, manufacturers are apt to overlook the best interests of the automobile user, and, too often, catchy complications are apt to become a nightmare for the builder. The car user of to-day is not a mechanic, and does not desire to become one, so the efforts of the builder should be to produce a car that will stand up under a minimum of attention. It was suggested that a study of the repair shop reports would be a valuable preliminary to the designing of a new model.

Fraud "Leagues" to Be Stopped.— Despite repeated public warnings, motorists all over the country are continually inveigled into purchasing so-called memberships in "automobile leagues" and "associations" which are formed for the sole purpose of getting the motorist's $5 or $10 membership fee. The American Automobile Association has finally taken up the matter officially, and hereafter will take vigorous steps against any and all promoters of such "leagues" and "co-operative associations." Motorists who have subscribed to such fraud leagues, or who have been approached by solicitors for them, are requested to notify the respective state or local automobile club affiliated with the American Automobile Association.

Radio Communication

Direct Public Wireless Service Between Japan and Other Countries was recently inaugurated between Ochiishi, on the east coast of the Hokkaido, and Petropavlovsk, in Kamchatka, Siberia. It is now possible to dispatch public messages from any post office in Japan to Petropavlovsk at 48 sen (about 25 cents in United States currency) per word.

Darien Station is Opened for Regular Service.—The United States Government has recently opened the Darien radio station for regular service. This station, situated in the Panama Canal Zone, is equipped with an arc generator of the Poulsen pattern and has a rated transmitting and receiving range of 4,000 miles. During the preliminary tests the station spoke with the Arlington station, a distance of about 2,000 miles.

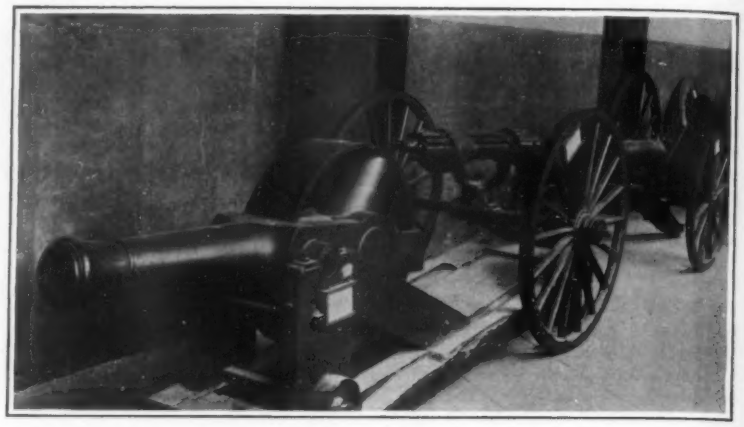
Annual Edition of List of Radio Stations.— The United States Bureau of Navigation has in the hands of the Public Printer its annual edition of the "List of Radio Stations of the United States," containing a list of 5,073 stations. The comparison between the number of stations in 1914 and 1915 is interesting. In 1914 there were 189 Government and commercial stations as compared to 224 in 1915; 895 Government and commercial ship stations as compared to 895—there being no increase in this class; 54 special land stations as compared to 118; and 2,796 general and restricted amateur stations as compared to 3,836, or an increase of 1,040.

Camp in Wireless Touch with Outside World.— During the past summer the members of the Massachusetts Institute of Technology summer school, encamped in the Maine woods, were kept in touch with the outside world by means of two wireless stations. Two wireless sets were employed by the students: One, a receiving set loaned to the campers by the United States Government; the other, a set built by the students. A flag pole was used as the support for the antenna, while the ground connection was in the form of a galvanized-iron pail, loaded with stones and sunk in a nearby lake; the copper connecting wires being wound around the pail to insure good contact. Although the camp was situated eight miles from the nearest village, the students were constantly informed as to the world's doings by wireless bulletins which were received by their apparatus.

Wireless Communication During Galveston Flood.—According to the *Wireless Age*, wireless telegraphy again proved that its usefulness is not limited to ship-to-shore communication, during the recent Galveston tornado. The flooding of the streets of that city resulted in putting the power, telegraph and telephone wires out of commission. The local Marconi station building was not damaged, but the water reached the apparatus and the mast was swept away. Thus communication with the outside world through regular channels was severed. However, the situation was soon improved by the army transport "Buford," which succeeded in establishing radio communication with Fort Sam Houston, about 250 miles away. The steamship "Concho" being in port, the Marconi operators from the Galveston station reported for duty on board that vessel and communication was established with the Marconi station at Port Arthur, Texas. Messages were handled for the steamship companies, the military authorities and the general public; this service being then the only means of communication between Galveston and the outside world. During the storm the mast and guy wires at the Marconi station at Port Arthur also gave way, messages being sent and received on the steamship "Wild Duck."

Radio Reports of Steamers Approaching Panama Canal.— Vessels approaching the Panama Canal Zone are requested by the Hydrographic Office of the United States Navy to send the following information by wireless: Their names, nationality, length, draft, tonnage; whether or not they desire to pass through the Canal, require coal, provisions, supplies, repairs, to go alongside of a wharf, the use of tugs; probable time of arrival, length of stay in port, and any other matters of importance or interest. If the information has previously been reported through agents or otherwise to the captain of the port, it is not necessary for a vessel to report by radio, but the probable time of arrival should always be sent. Furthermore, no radio tolls, either coast station or forwarding, will be imposed against ships on radiograms transmitted by ships on canal business. There will be no charge made against the Panama Canal by Canal Zone land lines or radio stations for the transmission of radiograms to ships on canal business. The naval service will make no charges from ships on messages sent by masters of vessels to any official in the Canal Zone, which messages contain information of the nature set forth above. Messages of this kind will be treated as canal business, and in order to facilitate accounting it is requested that such messages be checked "C B," denoting that the dispatches are sent on canal business.

Chinese machine-gun which was produced about 1300 A. D.



American revolving cannon used in the war of 1812

The Machine-Gun and Its Development

By Neal Truslow. Our Correspondent with the French Army at the Front

So far the Germans have proved themselves the masters of both the French and the English in the art of making for to-day the weapons of to-morrow. Instead of seeking to adapt new circumstances to old theories, they have changed their theories to meet the circumstances, and that is why they are able to make such a stubborn resistance. So firm is the German belief in machine-guns that they have nearly discarded the rifles. This, of course, is a shock, not only to military tradition, but to the popular conception of the soldier. Sloping rifles and gleaming bayonets are the fixed symbols of the army, and it is difficult, if not impossible, to imagine our soldier going into action with several yards of iron pipes under his arm. Yet statistics show that one machine-gun properly placed can hold a battalion. Twenty-one Germans are known to have held 1,100 yards of trenches for five months in a field, south of Soissons; several attacks were made against them without effect.

We should realize that a machine-gun, in competent hands, is accurate with a deadly accuracy. Tests against picked shots have shown that one machine-gun will make more hits than 50 marksmen, as there are rarely 50 marksmen in a regiment of 1,000 men. We may safely say that as a target hitter, a machine-gun is equal to a regiment.

The development of this most effective of the weapons has been very interesting, and much money and time spent in perfecting it. Few of us realize that the machine-guns of a primitive kind were found in the early history of gunpowder artillery.

In 1382, the army at Ghent put 200 chars de canon in the field, a number of barrels mounted on two-wheeled carriages, garnished with pikes and scythe-blades. In 1411 the Burgundian Army is said to have had 2,000 of these weapons. Louis the Twelfth had a machine-gun which fired 50 shots at one round.

And about this time, in Italy, we read of a more curious than useful weapon of four barrels, which was fired from the back of a donkey. Yet this is not strange, when we consider the work of a Canadian machine-gun crew which reached the trenches recently reduced to Lieutenant Cambell and Private Vincent. In default of a base, Lieutenant Cambell set up the machine-gun on the broad back of Private Vincent, and fired continuously until Lieutenant Cambell was wounded. Private Vincent then cut away the cartridge belt, abandoning the tripod and dragged the gun away to safety.

The *ribaudequin Chinois* captured from the Chinese by the French in 1860 is probably the earliest type of machine-gun known. Those who have knowledge of the Chinese believe that this model was produced somewhere about the beginning of the fourteenth century. It consists of a very heavy truck reinforced with iron, on which is mounted four iron barrels, 9 feet long. Since these barrels were practically stationary, they must have been used for a volley of grape or case shot

Using a machine-gun against air-craft

at very close range. They were fired simultaneously by a trail of powder leading to each fuse hole.

The next weapon important in the development of machine-guns was the Danish nine-barrel gun mounted in sets of three on a two-wheeled carriage. This proved of great value, and was effective in that one set of barrels could always be held in reserve, while the other was loaded. It was about this time that America startled the English with their bronze revolving cannon, capable of firing three charges in quick succession, this gun was very popular in the War of 1812, and doubtless was responsible for some of our sensational sea victories.

A satisfactory machine-gun was not found until breech-loading had been discovered. In 1860, Richard Gatling produced a gun which proved most successful in both the Civil and the Spanish wars. It was distinctly an infantry type gun. The ten barrels of which were set around an axis and fired in turn as the revolving mechanism operated by a crank brought them into position. Cartridges were arranged in a drum, and as one drum emptied another was put in its place. Experimental Gatlings were constructed, which could give a thousand shots per minute. This gun had a long range, and was used most effectively. But a grave disadvantage was the impossibility of avoiding frequent jams. Its weight and the necessity of operating the breech mechanism by hand were also serious objections. Other machine-guns of the hand-operated type rapidly followed, such as the Reffye, 1866, which weighed 2,710 pounds. The Requa battery, an artillery type, was tried by the United States Navy. The Hotchkiss, the Gardner, and numerous others had a vogue. But, next to the Gatling, the most important was the Nordenfeldt, which was designed, principally, for navy use, at the time when torpedo boats were beginning to be regarded as dangerous antagonists.

Hitherto we have been dealing with the more or less primitive type of guns. Possibly the great change in modern warfare has been due, largely, to the development of the modern automatic machine-gun. The loading, firing, extracting, and ejecting are all performed by the gun itself, either by the recoil of the barrel, the recoil of the breech or by a small portion of the gases of the explosion being allowed to escape through a minute opening in the barrel, near the muzzle.

Some 60 years ago, an American, Henry Bessemer, proposed and patented, in 1854, the system of using a portion of the gas for working the breech mechanism. But Hiram Maxim was the first to produce a finished automatic gun of practical value, of the recoil system, which was adopted by the British Government in 1889. In his gun, the barrel and breech casing are firmly fastened together. The former contains the barrel and water jacket used to keep down the high temperature caused by rapid firing which, by the action of a sliding valve, allows the escape of steam and not of water. The barrel has asbestos packing at its front and rear bearing, which allows of its sliding in

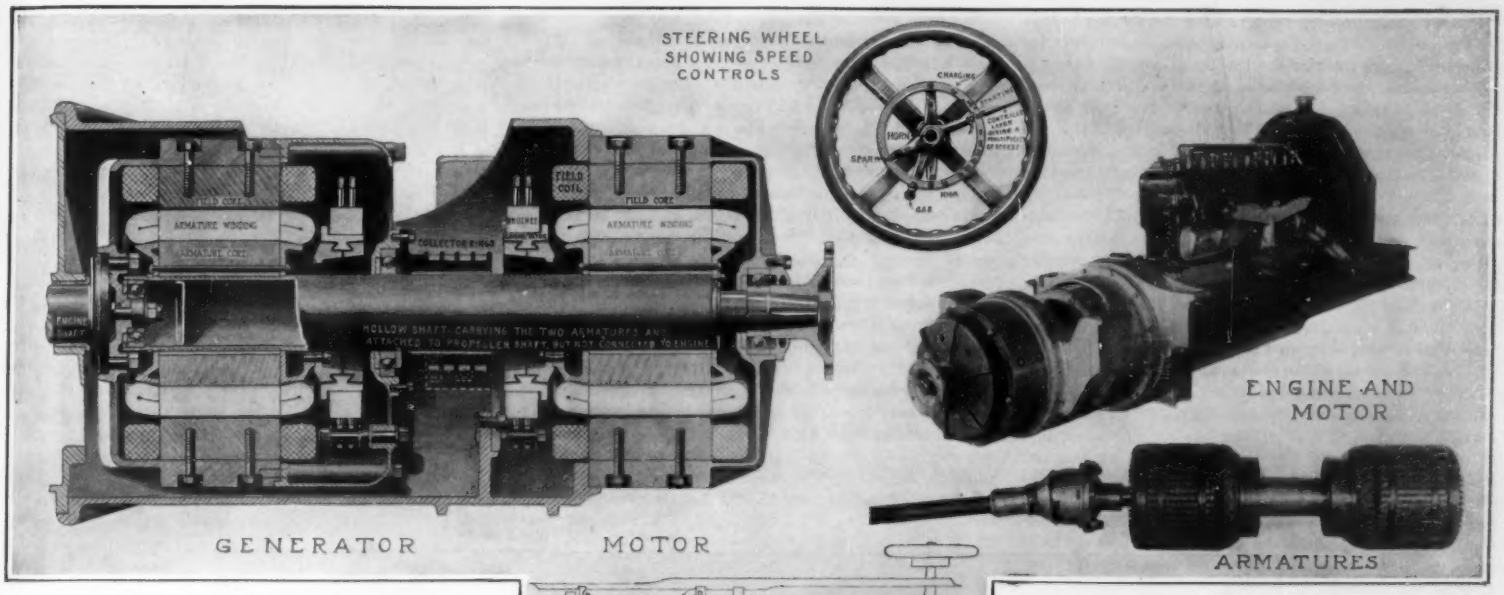
(*Concluded on page* 473)

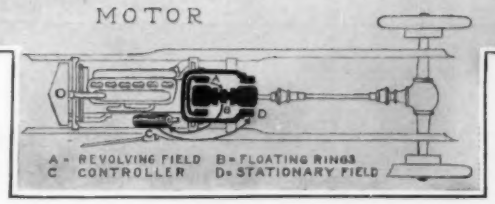
Danish 9-barrel gun of 1868 that fired 40 rounds per minute

Revolving cannon of 1868, breech loading, and firing 60 shots per minute

A Car with Electro-Magnetic Transmission

A Solution of the Change-Speed Gear Problem





WHY is it that the last note of commendation which can be struck in praise of one's car is to be able to state that it will take any practicable hill on "high speed"? There are many reasons, chief among which is the objection of the driver to taking his hand from the steering wheel to pull the change-speed lever. There is also the noise caused by the engagement of the gears; and, in the case of the four-cylinder motors, especially if the engine is working up to the full limit of its power, there is the danger that the car may become stalled. No driver wants to place his hand upon the change-speed lever if he can avoid it, and the motive for the production of the multi-cylinder car is the desire to produce a more constant torque on the propeller shaft and secure a car which can take hills on the high gear.

It was inevitable that, in the course of the development of the automobile, the advantages of an electric transmission should lead to a study of its availability in place of mechanical gears; and some ten years ago the Entz System was developed and applied to a car with very promising results; in fact, an Entz car of that date is still in use, and has to its credit a total running distance of 175,000 miles. In the interim since its appearance, the Entz System has been made the subject of very thorough investigation and experimental work by Mr. Owens, and the perfected car has been placed on the market during the present season.

Attention is directed to the accompanying illustrations by the aid of which the following description will suffice to make clear the details of this novel and decidedly interesting car. Commencing at the front end, we have first the engine, the fly wheel of which consists of the revolving field of the generator of the electro-magnetic transmission. It should be noted that the engine shaft terminates at this revolving field to which it is securely fastened, and that it has no mechanical connection with the propeller shaft. The transmission consists of a generator and a motor, the armatures of which are carried on the propeller shaft which terminates just inside the above-mentioned yoke on the engine shaft. Midway between the generator and the motor are shown the collector rings whose purpose is to connect the field current of the generator to the various circuits. The engine is controlled by a throttle pedal of the usual type, and on the steering wheel is a controller lever which acts on a series of resistance coils contained in an aluminum case at the foot of the steering column. This lever bears the same relation to the transmission gear as the controller of a trolley car to its motors. The relation of these electro-magnetic elements can be made clear by reference to the small diagram at the bottom of our illustrations. The current from the generator "A" passes through the floating rings "B" to the controller "C" from which it is led to the stationary field "D" of the driving motor. It should be borne in mind that the generator field runs at the same speed as the engine; that the motor field is stationary and that both armatures, being attached to the same shaft, revolve together at the propeller shaft speed.

The spinning of the generator field by the engine induces currents in the armature, with the result that there is a magnetic attraction between the armature and the field. The effect is that of a clutch, and the armature tends to turn with the field, which it will do so long as the resistance of the car does not prevent it. It will thus be evident that part of the work done by the engine induces electrical currents in the armature coils and part does the mechanical work of turning the armature and driving the car. The current thus created in the generator is led to the after or second part of the transmission which does its work as an electric motor.

It will be noted from our illustrations of the steering wheel that there are six positions of the controller lever, and the operations involved in starting and driving the car are as follows: The first advantage of the electro-magnetic system is that it can be used as its own self-starter, for when the current from the battery is switched into the generator (which occurs when the controller is on the starting notch), the generator serves as a motor and spins the engine. The controller is then moved to the first position, when the generator field windings cause excitation and prepare the generator for larger current demands. Moving to the second position the generator field is short circuited and a maximum current is produced, with the result that the field grips the armature, and current passes from the generator to the motor and assists in driving the car. In the third position, resistance is switched into the field coils of the motor. The load on the generator is increased, as is also the magnetic grip on the armature. In the fourth, fifth and sixth positions, increasing resistance is put into the motor field.

In the last, or high-speed position, the generator field is short circuited and no current is delivered to the motor or sent into any outside circuit. In other words, all the current generated is utilized to attract the armature and increase the torque of the propeller shaft. The amount of current produced is proportional to the difference of speed of the generator field and the generator armature. Thus, if the engine and generator field are running at 1,050 revolutions per minute and the generator armature at 1,000, only a very small amount of current, just sufficient to secure the clutch action, is generated. In climbing a hill, the difference of rotation of speed increases and the current is increased, as is also the grip on the armature. It will thus be seen that the clutch adjusts itself automatically to suit the load. It should be noted that in the high-gear position, a small shunt winding on the motor field which is switched into circuit, and the motor charges the battery.

A valuable feature of this system of transmission is that it can be utilized as a brake; for if the lever is put into the neutral position when the car is descending a hill, the current produced in the series winding of the electric motor is turned into the resistance coil employed in the charging position, which is used for boosting the battery. On a steep hill, this electric braking effect will keep down the speed to about twenty miles an hour.

The following is a summary of the advantages of this electro-magnetic transmission: It acts as its own self-starter; it eliminates the change-speed lever; it gives the widest possible range in speed control; and the interposition of an elastic transmission between the engine and the rear wheels gives a cushioning effect which is to the driving mechanism what the pneumatic tire is to the whole car. An interesting demonstration of its hill-climbing possibilities is to stop the car in the middle of a steep hill, hold it there by the proper adjustment of the controller, and then by operating the throttle-pedal, to start the car up the hill at one mile an hour or less and gradually accelerate it to its full capacity.

The Current Supplement

SCIENCE in the War and After the War is an address recently delivered before the British Association, and is reproduced in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2082, for November 27. It contains information and suggestions that are of value in this country. *Motion Pictures of Electrolysis* describes and illustrates one of the many applications of the moving picture camera to the study of technical problems. *The Electric Locomotive* contains valuable information and comparisons with steam that are timely in view of the great experiments in the electrification of railways that are now being tried out. There is an interesting account of *A Burning Oil Well*, which extinguished itself, together with a sensational picture. Too few people know that, as with men, there are good snakes and bad snakes; and that the good snakes are a valuable asset to the farmer. An authority on the subject tells us something of the matter in *Snakes and Their Value to the Agriculturist*, and illustrates the article with a number of excellent photographs. Stories about high explosives are constantly appearing in print, so the article describing, in not too technical language, the manufacture of *Synthetic Phenol and Picric Acid* has special value. *Potassium Photo-Electric Cells* is an interesting study of the photo-electric current, and the relationship of illumination and current. *Paint and Dye Testing* discusses the action of light and dyes, and describes the use of the white flame arc as a standard. There is the usual assortment of valuable shorter articles.

The Best Defence Against Chlorine

THE use of clouds of chlorine and bromine gases by the Germans in trench warfare has forced the Allies to use sponges or gauze soaked with some solution able to absorb the noxious gases. Ordinary "hypo" of the photographer, called sodium thiosulphate in the laboratory, is excellent for this purpose and is in common use. Unfortunately the reaction with chlorine or bromine liberates some hydrochloric acid and sulphuric acid, neither one very desirable in a sponge attached to a soldier's nose. The addition of sodium carbonate neutralizes these two acids but a French formula used a good deal does not call for enough sodium carbonate to take care of all the acid liberated. Seif has found that the correct mixture is:

	Parts.
Crystallized sodium carbonate (decahydrate)	60
Crystallized "hypo" (pentahydrate)	52
Water	100

The addition of plenty of glycerol prevents drying.

Strategic Moves of the War, November 17th, 1915

By Lieut. J. B. W. Gardiner, Formerly of the 11th Cavalry, U. S. A.

THE military problems confronting the Teuton-Bulgar armies when the campaign against Serbia was inaugurated were identical with those which Bulgaria alone faced at the beginning of the second Balkan war. This was obvious from the outset as the later situation was an almost perfect reproduction of its predecessor. In that war Serbia and Greece were allies against the common enemy, Bulgaria. The allied armies were not in close touch, the army of each being entirely in its own borders. The obvious strategy of the Bulgars was therefore to prevent a junction of the two allies by cutting the Saloniki-Nish railroad as near the Grecian border as possible, and thus isolate Serbia from Greece. As Greek numbers were much inferior to Serbian, a comparatively small Bulgar force could then act as a covering body to keep the Greeks within their territorial borders, while the main Bulgarian army was left free to engage the Serbians. The identical problem exists in southern Serbia to-day. In planning the Serbian invasion it was evident that the Teutons had decided to hack their way through as far, at least, as the Nish junction, so as to obtain complete control of the Oriental railroad to Constantinople. It was certain from the beginning and was, of course, so considered in the Teuton calculations that assistance would reach Serbia through Saloniki. Germany knew what the Allies should have known, but could not believe was true, that this assistance was not to be from Greece, but would have to come from the Entente as it then existed. But that help would come to the Serbians from Saloniki, whether English, French, or Greek, was a foregone conclusion. Thus was recreated the situation of 1913. The solution offered was the same. It was deemed necessary for the Bulgars to cut the Nish-Saloniki line, and, facing southeast, their line generally parallel to the railroad, to hold it against the Allies, and to isolate Serbia. Germany would then be free, without interruption, to blast the Serbian army out of existence and to destroy their kingdom, as they had done a year before in the case of Belgium.

Bird's-eye view of the operations in Serbia

In 1913, the Bulgarian plan, though at first successful, resulted later in complete failure, due probably to insufficient numbers. In 1915, it is again initially successful. Whether history will carry the repetition further, it is too early to prophesy. In the Balkan war the Bulgars cut the railroad at Gievgili and at the same time struck the Serbian main body, which was west of Ishtib, in front of the valley of the Vardar river. Their object in the latter was Veles and Uskub, the two points of junction of the Nish-Saloniki railroad with the main road of western Serbia, which follows the valley of the Ibar river. In the present war Gievgili was again, for a brief period, in the hands of the Bulgars. Their main offensive farther north, however, made such heavy demands on their strength that they were unable to deflect sufficient men to the south. The Allies advancing from Saloniki in ever-increasing numbers were therefore able to retake Gievgili by a threat against the Bulgarian stronghold of Strumitza, and to clear the railroad line from the Greek frontier to the confluence of the Vardar and Bregalnitza rivers, about fifteen miles southeast of Veles. And this is the situation as this article is written.

The object of the Allies at present is to open, and keep open, the road running northwest from Veles through Uskub so that this road may be used as a line of communication, both for purposes of retreat and reinforcement, for the Serbian army, which is retreating before the Germans down the Ibar valley. To accomplish this, Veles and Uskub must first be retaken. In addition, of course, is the necessity of effecting a junction with the main Serbian forces. Little by little, as their numbers increase, the French are moving up the Vardar. Their advance is slow, the Bulgarian resistance powerful. But the French flank is now so close to Veles that French cavalry patrols have already entered the town. A determined battle is in progress for the junction, which, if the French win it, will uncover first Ishtib and then Strumitza. The situation of the Serbian army is, however, fully as precarious, as the more pessimistic reports from Europe would lead us to believe. A review of the present positions will show just wherein the danger lies, and, in order that it may be more readily understood, reference must again be made to the railroads—the lines of which can be readily followed by reference to the accompanying map. The main stem of the Serbian railroad system is, of course, the Belgrade-Saloniki line, running generally north and south. Running eastward there are several branches, the only one of which that concerns the present status being the Oriental road from Nish to Sofia. Running westward, two branches are of present interest, one leaving the main stem at the small junction town of Stalách and following the valley of the western Morava, the other, indicated by dotted lines in the accompanying map. This latter branch was projected only a few years ago and it is not definitely assured that its construction has been completed. The first of these western branches has itself an important southern branch, which leaves it at Kraljevo, following the valley of the Ibar, and, passing through the Katchanik Pass, goes to Uskub and Veles. At Uskub it is joined, by an east and west link, to the Nish-Saloniki railroad, which road is reached also by an excellent highway from Veles. The eastern branch from Nish to Sofia is entirely in the hands of the Bulgarians. It is probably not in use as yet, as several of the tunnels through which it crosses the mountains were blown up by the Serbians in their retreat. But that is not a matter which concerns the present Serbian situation. It is sufficient that it is in Bulgarian hands. The first eastern branch through Kraljevo is securely in the hands of the Teutons, who have crossed it in their advance for almost its entire length. The greatest menace to the Serbian army is the cutting of the southerly branch down the Ibar valley—the one line of retreat and communication left open. It is along this line that the Serbians are falling back before the Teuton advance. Towards the south, however, this road has been cut some twenty miles north of Uskub, the Bulgarians having reached a position in front of the town of Kalkandelen, which they first took and were later ejected from. This town is not more than ten miles from the Albanian frontier. When this ten miles has been crossed either by a victory at Kalkandelen or at Katchanik Pass, fifteen miles farther north, the Serbian army is completely cut in two. The main line of the Teuton-Bulgar forces is, in general, a huge fish-hook, running almost due east from the vicinity of Visegrad to a point ten miles east of Nish, from which it curves towards the southwest, crossing the line of the Nish-Saloniki road to Katchanik and Kalkandelen. From the latter point the line runs southeast through Uskub and Veles, along the Vardar valley to Doiran near the Greek border. We need go, however, no farther south than Katchanik or Kalkandelen to find the danger that threatens the capture or annihilation of the Serbian army. Having cut the Serbian line of communications from the south, at the point of the hook, the Bulgars are both flattening out the curve by continuing to push westward between Nish and Vranja, but are also driving north in an endeavor to make the point meet the shank and so completely surround the Serbian forces. At the same time the Teutons are driving south to hasten the meeting. The gains during the past week have been small and unimportant. But this has been due not to any increase in power of the Serbian army, not to any weakening of the German pressure, but to the more difficult country that is being traversed. The first stage of the Serbian campaign—the capture of Nish and the consequent control of the railroad to Sofia has passed. The second stage, the capture or destruction, as a fighting force, of the Serbian army is well under way. As the situation now stands, retreat in only one direction is possible, and that direction is west, and moving westward, not only is there an almost total lack of transportation facilities, in the form of railroads or even good highways, but the country is extremely mountainous, offering the greatest difficulties to the transport of guns and baggage trains. The question of food supply will also soon reach an acute stage, if it has not already done so. Fully two thirds of Serbia is now in the hands of the Teuton-Bulgar forces. In addition, practically all the arsenals have been taken, so that failure of shell will be added to the threatening food famine. As the Germans move down the Ibar valley the source of supply to the Serbians operating against the Bulgars on the east becomes more and more seriously involved. One line is still open to the Serbs on this latter front—provided it has been completed—the line leaving the main railroad at Tchetchin and running through the fortified towns of Prokuplie, Kurshumlia and Prishtina, near the last of which places it joins the main line of the Ibar valley. But when the retreat takes place along this line it means that only a small corner of western Serbia will remain. This picture of the Serbian is not, from the viewpoint, a happy one to contemplate. But things are as they are, and the cloud of tragedy that has hovered over this brave but unfortunate people and their country, threatens to descend and completely engulf them.

(*Continued on page* 475)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Phonoptikon and the Optophone

To the Editor of the SCIENTIFIC AMERICAN:

I find in your issue of August 14th an account of F. C. Browne's "Phonoptikon," which is claimed to be an improvement on my "type-reading Optophone." As both instruments are described as enabling totally blind persons to read ordinary type by ear, some remarks on the respective merits of the two instruments may not be out of place.

The phonoptikon uses the net extra current obtained from a selenium cell mounted in a Wheatstone bridge when the cell is illuminated. This principle I adopted in my first exploring optophone (1912), but I discarded it on account of the slowness with which selenium recovers from illumination. In the Reading Optophone I use the fluctuations of current produced by intermittent illumination, and thus I reduce the effect of lag to about 1-1000 of a second. In fact, the response to light and to darkness is instantaneous. The available current is, of course, reduced in about the same proportion, so that sensitive telephone receivers of high resistance (8,000 ohms) have to be used. The telephone relay figured in my Royal Society paper I have also discarded, as it did not respond equally to different notes.

The claim to distinguish all the ordinary letters by means of only three components arranged vertically I can hardly regard as serious. In any case, I found six the minimum number, and with these all letters could be distinguished. The greatest difficulty encountered is to distinguish between "u" and "n," and even this was done without fail by Prof. Muirhead, of Birmingham, after 10 minutes' practice. I see no advantage in moving the receiver over the printed page instead of vice versa. The great practical difficulty is to maintain a good alinement, and in the phonoptikon as illustrated I see no contrivance for doing so. In the optophone this is done on the typewriter principle.

The two advantages which I do recognize in the phonoptikon are the absence of clockwork for producing intermittent light, and the fact that blank white paper gives no sound. On the other hand, there is a complex mechanism for current interruption; and the "black" response, while making learning much easier, will not, in my opinion, sensibly affect expert readers. The difference is similar to that between various systems of shorthand, where ease of acquisition only tells in the first stages. Besides, it is in general more appropriate that white should give a sound, and not black.

Now that the problem of ordinary reading for the blind has been seriously attacked along two different lines (and with complete success along at least one of them), we may hope that the instruments may soon become generally available. Here in England the scarcity of Nernst lamps and high-resistance telephones, due to the war, has practically stopped the manufacture of the optophone for the present. But American inventors and manufacturers are entirely free to use its principle in any way they choose. The main point is that those dwelling in darkness should perceive the light.

I am greatly interested in F. C. Browne's researches on selenium crystals, which clear up some hitherto obscure questions of theory. If these crystals are much more effective as receivers than ordinary "cells," it will be valuable, but I find it quite possible to obtain "normal galvanometric efficiencies" of 100,000 micrometers per lumen under standard conditions (1 volt, 1 lux, and ½ minute alternating exposure to light and dark) with cells provided with carbon electrodes. This is much in excess of the older results, and I should be glad to know whether the new crystals can surpass it.

Yours truly,

E. E. FOURNIER D'ALBE, D. Sc.

21 Gower Street, London.
September 22nd, 1915.

Rules of Practice of the United States Patent Office

To the Editor of the SCIENTIFIC AMERICAN:

I was interested in reading Mr. John F. Robb's letter in your issue of the 6th inst., but I cannot agree with all of his criticisms of the present rules of practice of the Patent Office.

First, in regard to his remarks on Rule 75 I fail to see where the public for which he pleads is concerned. Should an invention be donated to the public simply because one inventor, while describing an invention, failed to recognize or claim it, and another and earlier inventor of the same device be deprived of his rights for that reason? Under the law, one of the two inventors is entitled to a patent; is it material to the public which of them is granted the monopoly? I think not. As Mr. Robb rightly says, the omission of the claims from the first issued patent is sometimes the direct fault of the attorney; at others, however, it is because the patentee recognizes that he did not invent the particular structure shown, but, whatever the reason, the patentee must take the responsibility. Certainly neither is a reason for depriving a later applicant but earlier inventor of the fruits of his labor.

Mr. Robb seems to assume that all claims coming under this rule are broader than those in the patent back of which the applicant swears. More frequently I believe the claims are on parts or combinations of elements which do not form the main subject-matter of the patent. Often, also, the patents sworn back of show part only of the combination of elements of the claims, being cited with other patents to form a full anticipation.

Since the law gives the inventor two years from the date of his first public use of his invention within which to file his application, and since he is undoubtedly serving the public better if he actually reduces to practice and markets his invention instead of devoting his energies to establishing a constructive reduction to practice by filing his application and letting it lie, some such rule as Rule 75 is necessary and desirable.

I find this particularly well illustrated in my administration of the Patent Department of the Packard Motor Car Company. For instance, all the energies of the Engineering Department of the company were concentrated last year on the early production of the Packard Twin-Six, and there was little opportunity to get drawings out long enough to study and from which to prepare applications. Hence many applications have been delayed in filing, but the public is benefited in that the actual reduction to practice and the marketing is an accomplished fact. Certainly there would be no equity in depriving our inventors of the right to carry their dates back to their early drawings simply because some other inventor, for instance, had used the illustrations of our car which have been published broadcast in the trade magazines, to illustrate in his patent drawings some altered construction or attachment which he had devised, and had hurried his application into and through the office. Yet without Rule 75 we would be barred and would have no redress.

On the matter of multiplicity of claims I believe Mr. Robb is after the wrong class of cases. There will always be applications on large and complicated machinery that will require a hundred or two hundred or more claims to properly cover the subject-matter. The examiners in certain classes expect that, and are not objecting. The class of cases that are objectionable are the two to ten claim cases in which the attorneys insist upon asking for fifty or a hundred claims. To place a maximum limit on the number of claims would be of very doubtful validity, and also defeat the real object by encouraging a multiplicity of claims in the smaller cases where they are most objectionable. The remedy is the one used now of rejecting a claim or series of claims on another allowed claim.

The matters of oral prosecution of cases and of the form of specifications and claims do not seem to me to rightly come within the rules. The examiners frequently hold conferences with attorneys and save much time thereby. No rule is necessary to enlarge their powers in this regard. The proposals heretofore made and advocated I believe by the SCIENTIFIC AMERICAN to raise the standard of attorneys practising before the Patent Office by conducting examinations will do more toward raising the standard of patent specifications than prescribing rules, of doubtful validity, requiring a certain style of specification and claim writing that might fit one or a hundred cases, but that would be absolutely inapplicable to another. Let the Commissioner suggest and educate along these lines, but may he hesitate to tell us how we shall describe an invention that has not yet been made.

MILTON TIBBETTS,
Patent Counsel, PACKARD MOTOR CAR COMPANY.
Detroit, Mich.

The National Guard Question

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 23rd, "Patriot" complains of the fact that the National Guard is subject to the duty of protecting life and property. He says very truthfully indeed that the "regular army have proved themselves to be better able to patrol and keep order in strike districts than militia." Certainly, in what districts are they not better able? Does he not know why? Because they are trained officers and men, organized. Can his own organization truthfully be said to be composed of trained officers and men and really organized? No, only drilled. To what use does he propose to put the National Guard since he desires to abolish its original use? He answers immediately, "In time of war." But that is all he says. He cannot say that the Colorado Guard and the Texas Guard might board transports at San Francisco and proceed to Hawaii. He cannot even say that the Texas Guard might move to another state, because the Governor of Texas, protecting his own border, might tie-up the removal of his Guard until their need was probably past. He might say that he is prepared to enter as an organization at the outbreak of war the volunteer army for which provision was made in the last Congress. Then he is, in the height of excitement, to disorganize and reorganize. Fine prospects. About six months after this entry into the Volunteers he is beginning to get organized. Why, "Patriot," with all these difficulties, are you not striving for an establishment that will mean something instead of looking vainly for a place in our citizen-army for one who owes his allegiance first to his union, then to the law?

In the organization and plan of preservation of states it is contemplated, whether "it says so" or not, that universal compulsory military service shall be the power and protection of the state. Collective education emanates from the organized state. Military preparedness is nothing more than military education, with its physical adjuncts. The state (whether Federal or state) provides the means and wherewithal to take the seven-year-old child and give him his education. This, mind you, first for the good of the state. So, also, should the state take the, say twenty-year-old, man and give him his, say eight months, military education. And this one continuous tour of duty. His subsequent assignment to reserves and so forth is a matter for the General Staff and the General Board to settle and recommend to Congress. Officers? Yes, and non-commissioned officers could be provided as they are for instance, in the Army of the French Republic. But, of course, we Americans are all officers. You say, "My goodness, we would have a million men in our Army and Navy. That would be awful." Maybe so, but there is a hundred million of us and thousands of miles of sea-coast and foreign border around this richest land on earth, not mentioning our possessions.

Your National Guard, "Patriot," is a flimsy affair, makeshift and haphazard compared with a genuine military force. It deviates from its purpose at every possible point, just as you would now have it omit its cardinal duty. In our next war all the disorganizing and reorganizing, with the help of politics, will be carried out successfully within about eight months and the war will be confined to our own country where we have so carefully planned to wage it.

If you are an officer in the National Guard you are justly a patriot, for I am aware of the patriotism necessary to this labor. My respects. But let us all face the music and help secure for our country a military and naval establishment based on sound reasoning and the lessons of the past; instead of hopping first to one fad and then another, ultimately paying the penalty for providing only expedients. As an illustration: The congressman from this district, in a letter to the writer, under date of August 11th, makes the following statement: "It seems that the battleship has been of little use in this war in Europe." This absurd statement is made with a view of diverting money from battleships to airships and under-water craft as though one or the other should be built at the expense of the other.

CITIZEN.

Putting the Wood-Boring Larva to Work

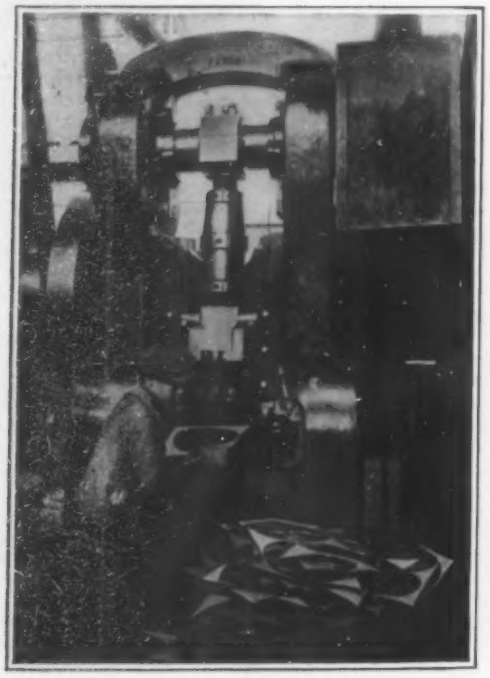
To the Editor of the SCIENTIFIC AMERICAN:

I have noticed several times that you published articles about wood-boring animals, but I do not remember seeing an article where such animals were put to work to achieve a practical end. The extract below from Smithsonian correspondence shows that result has been obtained, also how such work can be hastened. I would like to know if any person knows of such a method of boring a long hole, also if they can add any information to that given by Mr. Beede. Here is the extract which tells how the Sioux bore a tube for a tobacco pipe stem or musical instrument of ash wood:

"They go to a dead ash tree and capture a wood boring larva found in such trees. In the stick they wish bored they remove the pith for about three inches with a bone awl. In this cage they place the larva, and to expedite its work they heat the wood below the animal. It follows the pith, cutting a round hole about one quarter of an inch in diameter. A tube so formed they consider sacred and never enlarge its bore, and a larva so used is to them sacred; when its work is done it is carefully returned to where they got it. Their native name for the larva is Psechte-wabluskn, of brownish-black color, and a large one is about an inch long, possibly an Elaterid larva."—From the Rev. A. McG. Beede's (Sioux Co., North Dakota) letter of March 23rd, 1915.

It is very hard to get information about anything an Indian considers sacred. Possibly some person among your readers may have a personal knowledge of the use of a larva in making bores. E. H. HAWLEY.

Smithsonian Institution,
United States National Museum,
Washington, D. C.



Punch-press stamping out disks of thin sheet steel

First step in shaping the helmet crowns from the disks

Second and concluding step in shaping the crowns

Manufacture of Steel Helmets for the French Soldiers

Why and How Two Million of These Head Protectors Were Made in Six Months

By Jacques Boyer

IF the ante bellum conception of the French soldier was an individual dressed in baggy red trousers, bright blue coat, and soft, almost shapeless kepi or cap, surely the present-day conception is an utterly different one. Now we know him as the wearer of an inconspicuous but neat, well-fitting uniform of service gray, leggings to match, and an attractive steel helmet. The change in the appearance of the French soldier wrought by the first year of the European war has been truly revolutionizing: to one familiar with the French soldiers before the war, it would seem that the men who face the Germans from Arras to the Vosges are those of an unknown nation.

Sentimental reasons were responsible for the French soldiers wearing the same kind of uniform as did their fathers who fought in previous wars; but the military authorities, cognizant of the tremendous disadvantage under which the wearers of the vivid-colored uniforms fought, soon decided that sentiment would have to give way to practicability if the soldiers of the Republic were to be placed on a more equal footing with those of the enemy. Vivid colors were thus replaced by a service gray; bagginess was replaced by neatness; and, lastly, the soft kepi was replaced by a steel helmet, not because it was more attractive, but because it was a means of reducing casualties.

A group of finished helmets, showing the badges of the different arms of the French army

Trench warfare in France has, among many other unique characteristics, proved that the percentage of wounds in the head is considerably greater than in the pitched battles of former days. In a paper recently read before the Academy of Medicine of Paris, it was stated that 13.33 per cent of all the wounds inflicted on the French troops fighting in the Western theater of war are in the head, and head wounds are notoriously of a fatal character.

Moved by the large number of head injuries sustained by the soldiers in the trenches, the French Minister of War decided during the early months of the year to supply the fighters with metal helmets. After extensive experimenting at Bourges, France, with various types of head protectors, that suggested by a certain officer

Dressing the helmet crowns in a lathe to remove all irregularities

Soldering the helmet crowns and brims together, using gas torches

Making the helmet brims from scrap metal of punching operation

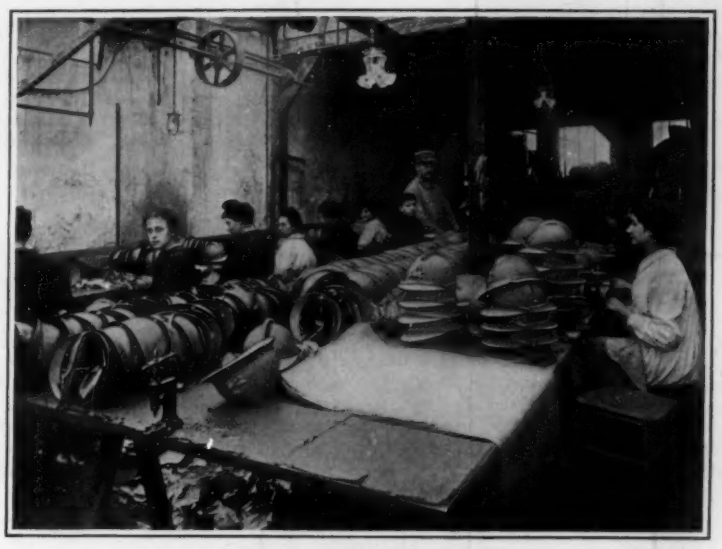
Adrian was adopted; the design of this steel helmet being such as to protect the head from shrapnel and ricocheting bullets more particularly. There followed almost immediately the work of manufacturing a sufficient number of helmets for all the soldiers at the front, and so smoothly and efficiently has the task progressed that to-day all men in active service wear them.

Although at a glance the steel helmets appear to be simple of manufacture, there are incurred no less than sixty-four separate and distinct steps before a complete helmet results. The first step consists of stamping out circles of sheet steel of .7 millimeter thickness. The punch press used for this purpose exerts a pressure of 150 tons on the cutting dies, and is under the control of the operator through the agency of a pedal. The capacity of the machine is 5,000 disks of steel per day.

The steel disks that have been produced in the first operation are then placed one by one in a pressing machine which forms each disk into a helmet with a broad rim. The partially formed headpieces are next sent through another pressing machine which completes this phase of the work by raising the helmet crown to the required height. The helmet crowns—the broad rim having disappeared in building up the crown to the necessary height—are then rotated one by one in a simple form of lathe and dressed with a cutting tool to remove all irregularities, followed by the polishing operation.

Meanwhile, the waste metal from the first step or punching out of the disks is being converted into brims on special shaping machines, each of which has a daily capacity of 12,000 pieces.

The next operation consists of punching the holes in the helmet crowns for ventilation purposes as well as for fastening on the crest, insignia and other accessories. The helmet crowns are held in a framework and all the holes punched at one time. This work accomplished, there comes the task of securing the metal brims to the helmet crowns. This is accomplished by soldering the parts together; a blow torch being used directly on the metal, instead of the customary soldering iron. Much time is thus saved.



Women workers lining the helmets and fastening on the leather straps—the final steps in manufacturing the new head protectors

At this point the helmets are virtually complete, lacking only the accessories such as the crest, the insignia of the arm by which each helmet is to be worn, the lining and the leather chin-straps. The crest and badge are attached by means of eyelets, following which the helmets are thoroughly cleaned and dipped in a special mixture which dulls them so that they will not be conspicuous on the field of battle.

The last steps in the manufacturing of the head protectors are the insertion of the lining and the fastening of the leather chin-straps. The latter are attached to the helmets by eyelets; small punch presses being used to pierce the leather.

The steel helmet in use by the French soldiers is at once neat and highly efficient. Dr. Devraigne in studying the value of these head protectors examined 55 cases of head injury, in which 42 of the wounded men had no head piece and 13 wore helmets. Of the 42, 23 had their skull fractured, and most of them died. The other 19 had merely scalp wounds. Of the 13 men who wore the steel helmets, eight were suffering more or less severely from shock, but none died. The other five had slight superficial wounds or scratches.

Since Dr. Devraigne's investigation, the steel helmet has had ample opportunity to prove its worth—and it has not failed to do so. During the recent offensive moves in France the helmets were much in evidence and, as a result, it is stated that the casualties were considerably less than they would otherwise have been.

In spite of the magnitude of the task of providing the French soldiers with metal helmets, five factories engaged solely in this work have succeeded in turning out over 2,000,000 of these head protectors in six months' time. They employ from five to six hundred men at various times and about 2,400 women.

A Shell With a Base-Cap That Precludes Premature Explosion

EVERY shell, be it from primary, secondary or torpedo defense battery, is expected to perform certain functions. Principal among these are:

To hit the target.

To burst at a predetermined point, virtually the target.

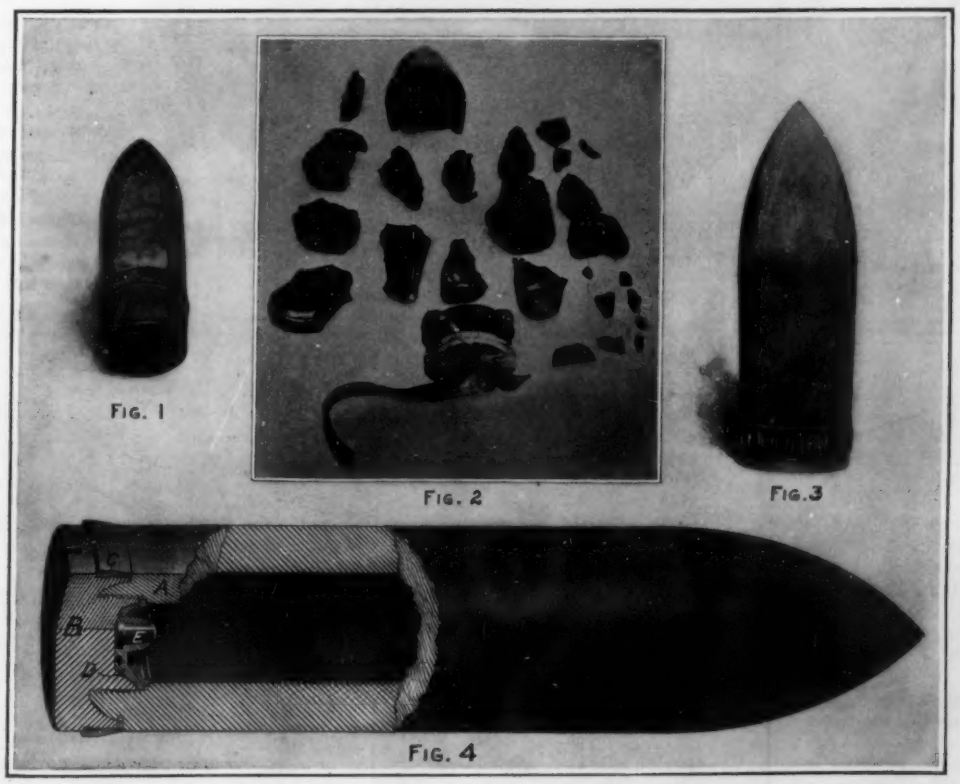
To attain the maximum muzzle velocity.

To afford maximum safety in loading, handling and inspection.

Each of the above functions depends, fundamentally, upon the construction of the shell. The first and third depend upon the nature and application of the soft metal rotating-band. The rotating-band imparts the gyroscopic action to the shell which keeps its axis closely tangent to the trajectory; in other words, makes it travel through the air and hit the target "nose on." It also acts as a gas-check in keeping the gases generated by the explosion of the propulsive charge from passing the shell in the bore of the gun, thus imparting the maximum velocity attainable to the shell. Obviously, if the rotating-band strips, slips or fits loosely into the rifling of an eroded gun, these functions will be defeated. In modern shell making the rotating-bands are shrunk into chased grooves around the body of the shells by means of hydraulic presses. They are therefore not renewable and far from positive, because it is by no means an uncommon sight to see a shell go "tumbling" in one direction and the band in another.

The correct timing of a shell depends, primarily, upon the efficiency of the fuse *E*. It is not an unknown occurrence for a shell to explode in the bore of the gun. This, however, can not be attributed to a faulty fuse because it is probably due to the admission of hot gases from the propulsive charge to the bursting charge along corroded threads of the fuse-plug. The fragmentation of a shell is the final test of its efficiency. In the use of comparatively slowly acting black powder for the bursting charge, which is sometimes necessary and preferable, the base-fuse has been known to blow out, because of the slight expansion of the shell-body, away from the plug, leaving the body practically intact, thus giving no fragmentation at all.

In our arsenals, loaded shells are stored for indeterminate lengths of time. Navy regulations require that a certain percentage of these shells be inspected at specified times. Shells have blown up during this inspection and it is thought that the explosions were due to the ignition of fine dust from a disintegrated bursting charge which had worked into the threads of the fuse-plug, by heat generated by friction when the plugs were screwed out.



Details of the new shell, also fragments of this shell after explosion

In 1911 the shell shown in the accompanying illustrations was developed by M. W. Glimartin, a chief gunner in the navy. The shell incorporates several important advantages over the service type, which should recommend it to ordnance experts. In place of a base-plug this shell has a cap, *B*. The rotating-band *C* is fitted to this cap by means of longitudinal lugs, screws or otherwise. This would permit the use of graduated bands for eroded guns if this were to prove feasible, as a band of the correct outer diameter could readily be fitted upon the cap aboard ship. Under present conditions, the accuracy life of larger guns is about 100 rounds, partly because after that many shots the rifling is eroded to such an extent that sufficient gas escapes by the shell to lower the muzzle velocity to a point where the accuracy of fire is seriously affected. This escape of gas in new or freshly retubed guns is prevented by the close fit of the rotating-band into the rifling. This application of the rotating-band to the base-cap would permit the adoption of the old muzzle-loading rotating-band feature. This adaptation would consist of ports in the after side of the band which would allow the gases of the propulsive charge to expand the band into the rifling of the gun, which is obviously impossible when the bands are forced into place with heavy presses. Having the band placed as it is in this shell brings it between the hot gases in the chamber of the gun and the opening into the bursting charge of the

(Concluded on page 475)

The Heavens in December, 1915

The Light of the Sun as Compared with That of Other Stars

By Prof. Henry Norris Russell, Ph.D

IT is not always that we realize that the resplendent sun is really but an insignificant member of the great democracy of stars, and seems so mighty to us only because he is so near a neighbor.

To place him correctly among his peers, as regards real brightness, is a difficult task even for the trained astronomer—not that the necessary calculations are either complicated or laborious—a schoolboy could perform them—but that the measurements upon which these calculations must be based are of great difficulty. We must know two things before we can figure out whether, and by how much, the sun's light exceeds in reality that of some other star—the star's distance and the ratio of the brightness of the sun and star as we see them. The determination of the former—once one of the most difficult of scientific problems—has in recent years become relatively easy, so that we now know the distances of many of the nearer stars, and of some remoter ones, which belong to clusters, with a degree of accuracy which enables us to calculate pretty closely how bright they all would look if set up side by side at some standard distance.

If, following Professor Kapteyn, this distance is chosen as equal to that which light would travel in 32½ years (or corresponding to a parallel of one tenth of a second of arc), it is found that some of the remoter stars, if brought to this distance, would appear so much brighter that they would far exceed any fixed star in our present skies, and a few of them would outshine Jupiter, and even rival Venus. Certain of our nearest stellar neighbors, on the other hand, would be apparently diminished in brightness if they were moved away to this distance, and would become invisible, not only to the naked eye, but in small telescopes, too.

The known change in the real brightness of the stars considerably exceeds a million-fold. Where in this long sequence does the sun come in? A moment's calculation shows that, if removed to Kapteyn's standard distance, the sun would appear 4,250,000,000,000 times fainter (4,250 billion times) than it does to us now; but how bright does it look to us compared with the stars? It is fully as hard to get a satisfactory answer to this question as it is to measure the distances of the stars—principally because the sun is more than ten thousand million times as bright as Sirius, and still more superior to any other star.

The only hope of getting measurements of light of such overwhelmingly different intensities is to devise some means of weakening the light of the sun in some very large but measurable ratio—say a hundred thousand or a million fold—and of concentrating and intensifying the light of the stars. The weakened sunlight will still be much brighter than the concentrated starlight; but they will no longer be so enormously different that it is impossible to compare them with the same laboratory source of light.

The ways in which this has been attempted are many, and each of the observers who have attacked the problem has tried a different one. This is obviously a fortunate circumstance, for in such work as this "constant errors" are most to be feared—that is, errors inherent in the instruments, or in some feature of the method, and not capable of elimination by merely multiplying observations with the same instrumental appliances. But when, as is actually the case, observations made by four different men, using as many different methods of observation, agree in a satisfactory fashion, it is clear that far more confidence may be placed in the average of their results than could have been reposed in that of a single observer, however careful and distinguished.

The first reliable measurement of the comparative brightness of the sun and a star was made by the German astronomer, Zöllner—one of the founders of the science of exact measurements in photometry—in the year 1864. By means of a combination of lenses, like a telescope turned wrong end first, he produced a diminished, star-like, image of the sun, which was further weakened by the interposition of a dense shade-glass in the path of the rays. Another combination, much like an ordinary telescope, produced a bright image of the star Capella. These images were compared with an "artificial star" formed by the light of a lamp shining through a small hole. After allowing for the weakening of the sunlight, and strengthening of the starlight, in passing through his apparatus (the amounts of both being determined by careful measurements), Zöllner concluded that the sun appears to us to be 56,000,000,000 times brighter than that of Capella.

No other measures were made for nearly forty years, when three observers, French, Russian, and American, attacked the problem independently and almost at the same time.

Fabry, at Marseilles, compared the brightness of sunlight, spread out upon a screen into a wide and faint circle after passage through a small lens of short focus, with the illumination of the same screen by a standard electric lamp at a known distance, and later compared the small star-like image of this lamp produced by means of a microscope lens with the star Vega seen direct. His result, reduced to the terms of the foregoing, made the sun 64,000,000,000 times brighter than Capella.

Ceraski, at Moscow, adopted the very different plan of setting up a small convex mirror at a distance of about 500 feet, from which a star-like image of the sun was reflected, and comparing this with the planet Venus, which at the time was very bright and visible in full daylight. It was then relatively easy to compare the brightness of Venus with that of known stars. His final result makes the sun 53,000,000,000 times as bright as Capella. Finally, Professor W. H. Pickering, of Harvard, observing at the Observatory's tropical station on the Island of Jamaica in the West Indies, with a telescope of the unusually great length of 135 feet, adopted the plan of allowing the sun to shine into the telescope through a little hole, about 1-25 of an inch in diameter, thus forming on a screen a large but faint solar image, some 16 inches across. The brightness of this image was compared with that of the illumination of the same screen by a standard lamp.

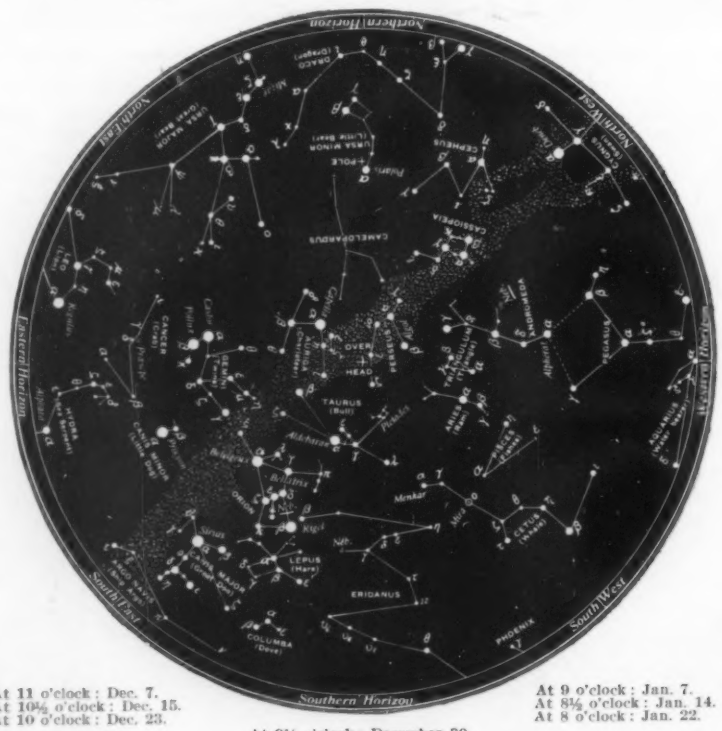
Then, on the next night, the light of a star shining through the full 12-inch aperture of the telescope, and concentrated by the lens into a little spot perhaps ⅛ of an inch across (observed near, but not at, the focus) was received on the same screen and compared with the same lamp. His mean result makes the sun 66,000,000,000 times brighter than Capella.

The average of these four results, which makes the sun 60 billions of times (60,000,000,000 times) brighter than this star, must be very near to the truth, for the results of the four observers differ from it, on the average, by only 9 per cent. of its value, and it is highly improbable that they are all in error in the same direction.

It follows from this result that, if the sun could be removed to Kapteyn's standard distance, it would appear as of only one seventieth the brightness of Capella—that is, as a star only a little brighter than the fifth magnitude, and just comfortably visible to the unaided eye.

Capella itself is considerably beyond the standard distance, and is actually about 150 times as bright as the sun. The sun, indeed, takes a place near the middle of the sequence of stars, when placed in the order of their real brightness, some of the brightest, such as those in Orion, Scorpio, and the Southern Cross, being several thousand times his superior, while others—faint telescopic stars in our immediate neighborhood—from the standpoint of stellar astronomy, are more than 1,000 times fainter than he.

As regards apparent brightness, the faintest stars which can be photographed with the great telescope at Mount Nelson send us so little light that it would take 500,000,000,000,000,000—five hundred millions of billions—of them to send us as much light as does the sun.



At 11 o'clock: Dec. 7.
At 10½ o'clock: Dec. 15.
At 10 o'clock: Dec. 23.

At 9 o'clock: Jan. 7.
At 8½ o'clock: Jan. 14.
At 8 o'clock: Jan. 22.

At 9½ o'clock: December 30.

NIGHT SKY: DECEMBER AND JANUARY

The Heavens

Our map shows how brilliant the winter skies have become. The magnificent region which centers in Orion is high in the southeast. Nearest the horizon is Canis Major, whose leading luminary, Sirius, so far outshines the others that it is not until he is hidden from view behind one's outstretched hand that it is easy to realize that several other stars in the constellation are brighter than the second magnitude. Sirius owes his brightness solely to his proximity to our system; if placed as far off as his apparent neighbors, who belong to the great and enormously remote group of "Orion stars," he would, in all probability, be invisible to the naked eye.

Orion himself needs no long description, for he is one of the most familiar constellations in the heavens. The lowest of the three stars of the sword—the little group below the belt—is a pretty naked-eye double, and both the others are resolved in a field glass. The great nebula which spreads all over this region is only fully revealed by photography—though the brighter central part is one of the finest of telescopic objects.

Taurus, still higher up, is marked by the V-shaped group of the Hyades, and the conspicuous, though not very brilliant cluster of the Pleiades, in which six stars are conspicuous to the eye, and five fainter ones can be seen on a clear dark night. Right overhead we find Perseus and Auriga—both fine constellations on the Milky Way.

Passing downward to the east we come upon Gemini—whose familiar outlines are now strangely modified by the presence of Saturn, who outshines all of its stars—and Canis Minor, with its one bright star, Procyon.

Lower down are the head of Hydra, Cancer, and Leo, the last rising.

The Great Bear is coming up in the northeast, while the Little Bear and Draco are low in the north. Cepheus and Cassiopeia are in the northwest, above Cygnus, which has partly set. Pegasus and Andromeda are due west, while Cetus and Eridanus fill the great dull region in the southwest.

The Planets

Mercury is in conjunction with the sun on the 15th, behind him and at about his greatest possible distance from the earth, 138,000,000 miles. He is practically invisible this month.

Venus, though still very far south, is gradually coming into view, in the evening sky, and sets at about 6:45 P.M. at the end of the month.

Mars is approaching opposition, and becoming steadily brighter. He is in Leo, and passes within 3 deg. of Regulus on the 12th. He rises about 11:15 P.M. on December 1st, and 8:50 on January 1st. By the latter date he is equal to Saturn, and brighter than anything else in sight, except Sirius. Jupiter is in quadrature on the 12th, and is an evening star in Pisces, setting at 11:40 P.M. Saturn is in Gemini, very near opposition,

(*Concluded on page 476*)

Military Tool with Wide Variety of Uses

THE great amount of constructional work involved in modern warfare, in the form of trenches, barbed wire entanglements and miscellaneous obstructions, bomb-proof shelters, block houses and other forms of defences, causes no little interest to be centered on a recently invented combination tool that may be employed for a number of diversified tasks.

As may be seen in the accompanying illustration showing the new tool employed in different forms of work, the implement consists of a top piece that can be used as an axe on one side and a mattock on the other; a saw member which, when not required, can be folded out of the way into a slot in the handle; and a shovel at the bottom, which may be detached when using the saw or top member. The tool is provided with a sling for holding it to the belt of the soldier.

The combination of the various tools required by the soldiers of to-day into one tool possesses a number of striking advantages which are immediately obvious; the weight of the equipment not only being reduced to a marked degree and extreme compactness obtained, but the fact that all tools are combined together tends to lessen the possibilities of misplacing or losing them.

Combination military tool and the different tasks to which it may be put

Wide-Spread Use of the Steam Road Locomotive in England

IN England, the motor truck is not the only competitor the horse has to contend with in the haulage of heavy loads over highways; the steam road locomotive being most popular and extensively used.

The general design of the British road locomotives is not unlike that of the tractors for agricultural purposes, although the main road axle is of larger diameter, the gearing is stronger, both front and back axles are fitted with springs, and a front tank is provided which increases the water capacity considerably. A typical single cylinder road locomotive is of six horsepower nominal rating. The diameter of the flywheel is 4 feet 6 inches and it revolves at 160 revolutions per minute. The diameter of the driving wheels is 6 feet, while the width of each is 1 foot 6 inches. The extreme length of the machine is 16 feet 6 inches, and its width 7 feet 2 inches. The approximate weight of the engine is 10 tons, empty. The working pressure of the boiler is 150 pounds to the square inch. On high speed the locomotive travels at six miles an hour, hauling full load.

English steam road locomotive operating in the flood of 1915 at Salisbury Plains

Another type of British road locomotive is fitted with a compound cylinder engine and is more economical than the single cylinder machines. Besides, it is easier to start with a load, especially on a hill or on a bad road, if two cranks are used in applying the engine's power. The exhaust is considerably less noisy than with a single cylinder engine because of the greater expansion of the steam and the consequent lower pressure of the exhaust. To facilitate starting there is used an auxiliary valve which permits of admitting high pressure steam to the low pressure cylinder. As in the case of the single cylinder road locomotive, the compound cylinder machine compared to the steam tractor for agricultural purposes has extra strength in the gearing, shafts and axles, as well as a front water tank. Besides, it is fitted with a slip winding drum and 75 yards of steel wire rope.

It is claimed that the compound engine, properly managed, will effect a saving of from 20 to 25 per cent in fuel and water over the single cylinder machine. The larger compound cylinder road locomotive is of 10 horse-power capacity. The flywheel used is 4 feet 6 inches and rotates at a speed of 160 revolutions per minute. The diameter of the driving wheels is 7 feet, the extreme length 19 feet, and the width 7 feet 6 inches. Under normal conditions and hauling its capacity load it will make speeds of from 2½ to 6 miles per hour, and weighs 14 tons, empty.

Device for the Simultaneous Playing of Violin and Piano

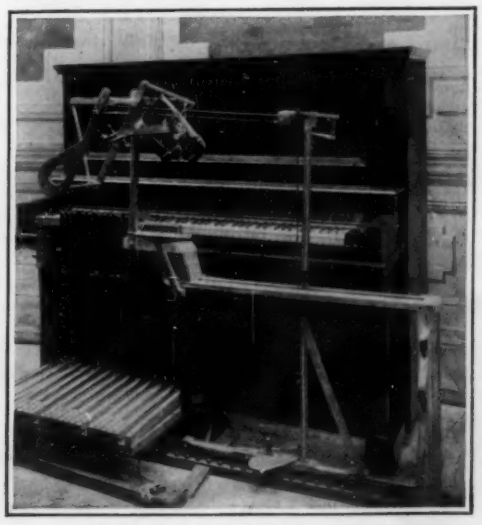
BY means of the ingenious combination of levers and mechanical movements comprising the invention of Mayor Harry L. Sutter of Moscow, Ohio, it is possible for one person to play simultaneously a piano and a violin, using ten toes, eight fingers, two thumbs and two forearms.

That the player manipulating the piano and violin through the aid of the device is pretty much occupied is evinced by the fact that two hands and two feet are required for the purpose. The bass notes of the piano accompaniment are controlled through the toes of the left foot, working on pedals connected with the levers that rest on the piano keys. The right hand plays the solo notes directly on the piano.

The bow of the violin is held in a small vise which in turn is attached to an upright; the lower end of the upright being held on a base which is provided with four small, flanged wheels traveling on a short length of track. The right foot of the player serves to move the base and in that way draw the bow over the violin string. The violin is held in a double vise fitted with a piece in which is bored a hole; the player, passing his left arm through the hole, can control the tilting of the instrument so that the proper string is brought into contact with the bow. The fingers of the left hand rest on the strings of the violin as in conventional practice.

In playing a piano and a violin simultaneously by means of this device, it is necessary for the musician to concentrate his mind on the work, since toes, fingers and forearms are called upon to perform their respective functions and must play in proper unison with each other.

Musician playing a piano and violin with his hands and feet



A device that renders possible the simultaneous playing of a piano and a violin

Etherometer—An Apparatus for Mechanically Administering Anaesthetics

Apparatus for Mechanical Administration of Anaesthetics

KNOWN as the "Etherometer," there has been developed by Frederic Montgomery, M.D., Chief Anæsthetist, Woman's Hospital, New York city, an apparatus for the mechanical administration of anæsthetics.

Briefly, the etherometer may be compared in con-

(Continued on page 473)

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Electricity Replacing Oil in Railroad Hand Lanterns

OF the many applications of the battery lamps perhaps none is more important than that of replacing the conventional oil lantern of railroad men. An electric lantern invented by a brakeman, F. T. Baird, of the Chicago & Rock Island Railway, has already been adopted by several leading railroads because of its numerous advantages over the ordinary oil lamps.

The most novel feature of the new electric lamp is that its fungsten bulb is placed beneath the battery container, protected by both its own guard as well as the framework of the base, so that the light is thrown downward in full strength. The majority of oil and electric lanterns in common use are so constructed that the source of illumination is placed above the container for the battery or oil, causing a large shaded area to exist below the lamp. The elimination of this shadow renders the new lamp ideal for railroad purposes, particularly in signaling.

The operation of the new electric lantern is most simple. By lowering the bail to one side its full distance, the light is turned on and locked. To extinguish the light, it is necessary to tip the lantern to the other side and drop the bail on that side as far as it will go. This feature prevents the light from being accidentally turned off should the lantern be set on the ground and the bail dropped to the side where ordinarily the light would be turned off. The bail snaps into place when in the vertical position in which it is mostly used.

The life of the batteries employed in the new lantern is largely problematical, depending in a great measure on whether the lamp is used continuously or intermittently. Experiments conducted by leading railroads have indicated that the lamp may be used seventy-two hours for intermittent service, while the inventor himself has found the batteries capable of forty-two hours' continuous service without complete exhaustion.

While primarily intended for railroad service, the lamp may be used in the home, in mines, on the farm, by contractors, by sportsmen and campers, and by automobilists—in fact, by any one who desires a compact and convenient hand lantern. A lantern of this type was recently used by one of the divers engaged in the salvage work on the "Eastland" wreck at Chicago.

Harry Halverson, Government diver, using an electric lantern in the salvage of the steamer "Eastland"

Shell-Case Turning Lathe with Pneumatically-Operated Clutch

THE unprecedented demand for ammunition in enormous quantities to feed the guns of the fighting forces of Europe has had a marked influence on the design of munition-factory equipment. Every effort is being made in designing the machines to facilitate quantity production.

A lathe for turning the bands on shell cases, which has recently begun to make its appearance in the munition factories of the United States, has for a novel feature a pneumatically-operated clutch. A general view of the lathe and drawings of its mechanism appear in the accompanying illustrations.

The driving power of the new lathe is applied through a 22 x 8 inch clutch pulley, mounted on the spindle and bushed with bronze. The clutch is in the form of a cone of hard maple, and is made the full size of the inside of the pulley; its operation being controlled by a compressed air piston which in turn is actuated by a valve placed within convenient reach of the operator's hand. The entire clutch mechanism is built into the spindle and when in use has no tendency to move the spindle endwise or cause end friction. Means

Lathe for cutting bands on shell cases, fitted with pneumatically-controlled clutch and chuck

are provided for taking up the end play of the spindle should any wear occur.

The same piston that actuates the clutch when compressed air is admitted through a hand valve also serves to operate the clutch; the two operations being accomplished at one time. The chuck is of the draw-in type and is built into the enlarged end of the spindle.

Other details of this lathe are interesting, although of secondary importance as regards uniqueness. The tool slide base is of substantial construction and clamped immovably to the lathe bed. The front or roughing tool is fed in by means of a screw and hand wheel to a dead stop, leaving a light cut for the finishing tool. The latter is mounted to the rear and above the work. The tool can be adjusted to pass down behind the shell and in passing shave the band to size. The feed is by lever and pinion. The tools, which are held in steel blocks by a clamp gripping the dove-tailed portion of each tool, can be removed for grinding and replaced with precision.

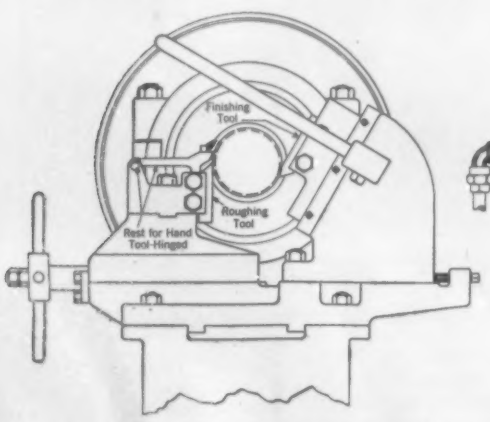
The shell that is inserted in the chuck of the lathe is located by a counter-weighted arm fastened to the bed, which is swung down to butt the shell until the air valve is turned out, simultaneously throwing on the power and operating the chuck. A hinged scraper rest is provided on the front tool block for removing the ragged edge at each side of the band after tooling.

Substantial in every respect, the lathe is capable of withstanding the trying service to which munition equipment is now being put. The bearings are unusually heavy, which likewise applies to the bed and the legs. About ten horse-power is required to operate the machine, while the compressed air for the control is required in but small quantities and at any available pressure.

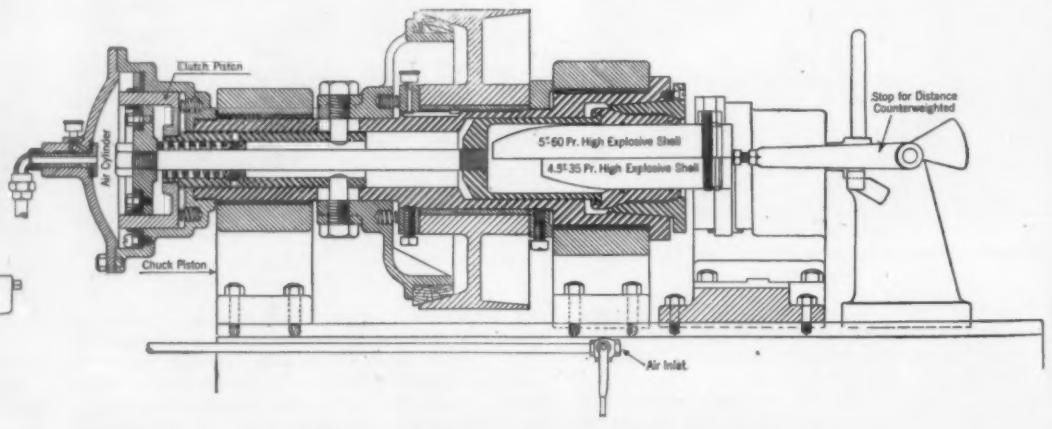
Doctor Edward Livingston Trudeau

HIPPOCRATES wrote of consumption as causing, of all diseases, the most suffering and the greatest number of deaths. And to this day, twenty-two centuries after, tuberculosis retains this gruesome distinction. Celses, Nero's physician, advised the tuberculous to buy a cow, to go with his purchase to the top of a mountain, and to "live on the fruit of that cow." Here was the basis of that modern treatment of tuberculosis which Bodington sought but failed, by reason of persecution, to establish, in England, about 1840; which Brehmer firmly established in Germany; and of which Trudeau was the pioneer champion in America.

When Trudeau was twenty-six he was considered hopelessly consumptive—for all such sufferers practically no hope was then entertained; his physicians gave him six months to live. Nevertheless, for forty years he triumphed over that most grievous malady, up to his decease, November 15th, last. And during those two score years many thousands of men and women who suffered like him have not died, but have lived to bless, with utmost gratitude, his name. And this by reason of his personal ministrations; of the inspiration inherent in his fortitude and his invincible optimism; and because of his teaching within his own profession that tuberculosis in the primary stage is curable; that many moderately advanced cases are either curable or can be arrested as to the ravages of the disease; that where there is no cure, relief and comfort and prolongation of days can generally be assured. His monument is the Adirondack Cottage Sanitarium, begun as a one-room structure, near Saranac Lake, where, a man above 6 feet tall and "weighing about as much as a sheepskin," he went in 1873 to begin his superb and triumphant battle with the Captain of the Men of Death.



End view of the shell-turning lathe, showing arrangement of cutting tools



Sectional view of the pneumatically-operated mechanism of the new shell-case turning lathe

The Machine-Gun and Its Development

(Concluded from page 464.)

recoil, the breach casing is a rectangular box containing lock and firing mechanism. At the rear it has two handles by which the gun is directed.

In the Maxim, the gun which is now being used by both the English and the Germans, the total recoil of the barrel is about 1 inch. The side plates and lock all recoil together about ¼ of an inch without any disturbance of the lock, and by the time this short travel is complete, the bullet has left the muzzle. The force of the recoil then operates the mechanism which opens the breech, ejects the cartridge, a spring expands, which when relieved closes the breech after taking a new shell from the cartridge belt and placing it in readiness to fire.

The Maxim gun is light and easily handled, weighing from 50 to 60 pounds, and fires from 450 to 600 rounds per minute. The cartridge belt contains 250 rounds, and is provided with a catch which makes it possible to add any number of belts while the gun is in operation. These belts are loaded back of the line by machinery. The greatest objection to this gun seems to be that, at the end of 300 to 400 rounds, the water in the jacket boils, throwing off quantities of steam, disclosing the position of the gun. The Germans ingeniously use a tube to carry off this steam. There is also the frequent difficulty of the 5 pints of water contained in the jacket boiling away, leaving the gun with absolutely no radiation.

The Hotchkiss type, which has been adopted by the French Army, depends for its action on the use of a small portion of gas from the explosion itself. The barrel is attached firmly to the frame. The latter containing the breech and firing mechanism under the barrel, and, communicating with it by a post, is a cylinder tube. When the gun is fired and the bullet has passed the post, a portion of the gas of the explosion passes into the cylinder and drives back the piston contained in it, a lug on the underside of which compresses a spring, which, when the trigger is pulled, drives back the piston again. The reciprocating motion of the piston performs all the process of loading and firing the gun. The action being continuous as long as the trigger is held. Cartridges are placed in feeding strips, containing 50 rounds each; when the last shot has been fired, a stop holds the piston and block ready for a fresh strip to be inserted.

The Hotchkiss has many advantages, its working parts are very simple and easily repaired, it is light, weighing 53 pounds, and fires 500 to 600 times per minute. No water is required for the radiation of the heat, generated by rapid fire, as that is facilitated by the radiation which consists of rings on the barrel close to the breech offering an increased surface to the air.

The Colt automatic gun, adopted by the American and English armies, weighs 40 pounds, and is extremely simple and compact. Its operation is similar to the Hotchkiss, using the gases through a post near the muzzle to operate a piston. But its novel feature is that the air is compressed in the rear of the piston as it is driven back, passing through a tube to the breech, thus a puff of air is blown through the barrel after each shot, cleaning out foul and unconsumed powder and assisting to a considerable extent in keeping down the temperature of the barrel. The gun will fire 100 times per minute, and its compactness makes it very portable.

In talking with a well-known general at the Ecole Militaire, the other day, he said: "The English hold their trenches with the infantry, the French with artillery, but the Germans with machine-guns." There is, no doubt, that the contribution which this war is destined to make to the science of warfare lies in the direction of the development of the machine-gun. I am in a position to know that the Germans started the war with 50,000 machine-guns, and, while that number was approximately accurate then, the number is enormously increased to-day. Machine-guns are cheap. The parts are easily duplicated, and the general claims that it is just as easy to make a serviceable machine-gun as a rifle. The Allies have increased the number of their machine-guns, but the Germans have done the same. Now, they are going further, they are virtually substituting men armed with machine-guns for the old-fashioned infantry armed with rifles. They are holding their vast line with a very small number of men armed with machine-guns protected with concrete work and wire entanglements. Their infantry is only brought up in emergencies, and is not constantly exposed to bombardment. Their machine-guns are sheltered by steel plates, and can only be put out of action by a direct hit with a high explosive shell.

The Allies were soon to realize how much ground they had to make up in the matter of machine-guns, so in addition to the school of musketry and artillery both the French and the English have established the machine-gun school. It is a place of hard work and quick thinking. It would be inexpedient to dwell on the nature of the work carried on at the school, but I may say that the school is in daily touch with every phase of machine-gun warfare at the front.

As far as the army in the field is concerned, the machine-gun is coming into its own, both officers and men who came up for machine-gun training have thrown themselves with the utmost keenness into the new form of warfare which the machine-gun has introduced.

The advantage of the increased firing power of the machine-gun is so obvious that it need not be dwelt on. It has already been adopted in some foreign armies; every fourth man in the Brazilian cavalry is, I believe, armed with one. It will be only a short time, I hope, until our National Guard will realize the importance of these weapons, and will be properly drilled and equipped with this most effective of weapons of defense. No army can live before them. No strategy can outwit them.

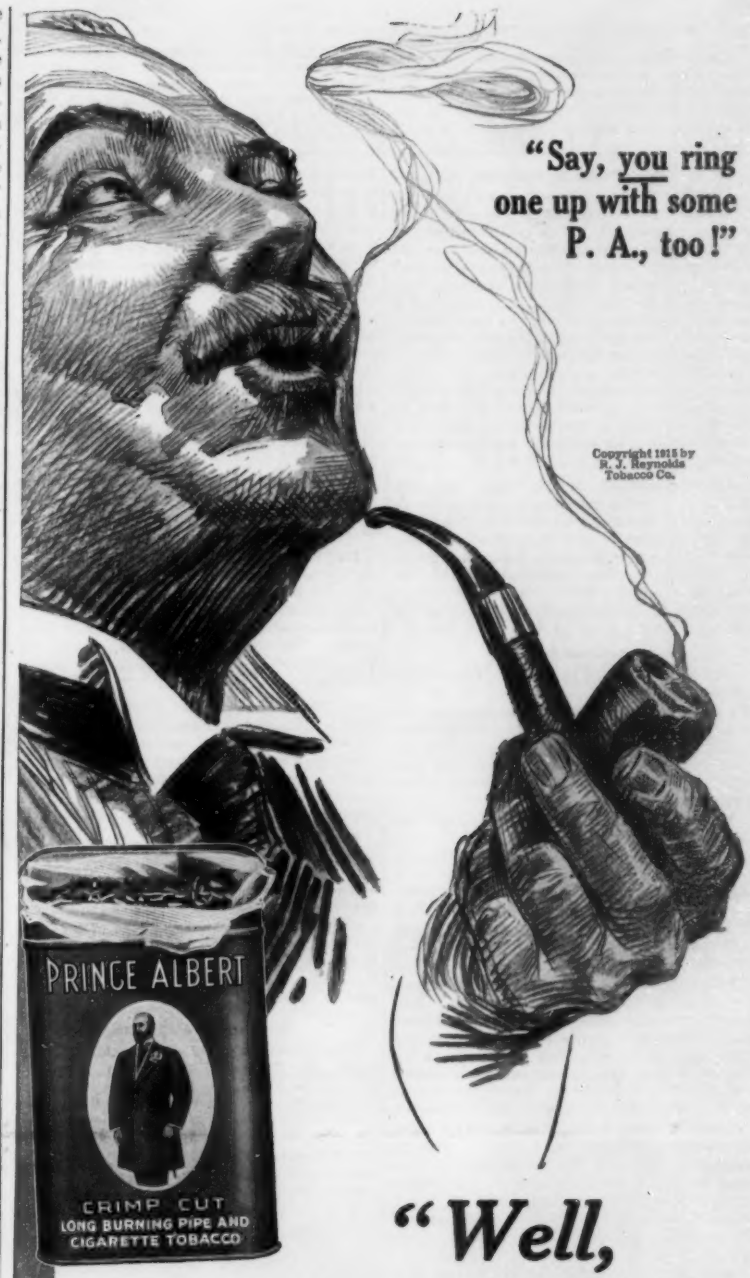
Apparatus for Mechanical Administration of Anaesthetics

(Continued from page 471)

struction and mechanical principle to a vichy siphon. It consists of an air-tight, graduated glass container having a cap arranged with two valves. One valve is an inlet valve for air, similar to the valve in an automobile or bicycle tire which permits air to enter but automatically prevents its escape. The other valve is an outlet valve to control the flow of anæsthetic forced out under the air pressure. This valve is so adjusted that the number of drops per minute discharged from the container may be accurately controlled. The air pressure necessary to operate the device is obtained by means of a small rubber hand bulb similar to an atomizer bulb. This bulb is only used to charge the apparatus, after which it is removed just as in the case of a vehicle tire after it has been inflated. When the etherometer is filled with the anæsthetic and charged with air in this way it is ready for use and will operate automatically until it is emptied. The anæsthetic is discharged through a long flexible tube to the face mask where it is diffused upon the gauze by means of multi-perforated tubes arranged in the mask. All the anæsthetist has to do is to place the mask upon the patient's face and turn the valve so that the requisite number of drops per minute are flowing to the mask. The rate of flow is observed through the glass sight feed on the cap.

The new apparatus affords a marked contrast with the conventional methods in use to-day for the administration of anæsthetics. The latter, it is said, are at the best exceedingly crude and, unless under the supervision of a professional anæsthetist, are more or less haphazard and not productive of the best results. On the other hand, the mechanical method of applying anæsthetics is at all times under control, although it will perform its

(Concluded on page 475)


"Say, you ring one up with some P. A., too!"
Copyright 1915 by R. J. Reynolds Tobacco Co.
PRINCE ALBERT
CRIMP CUT
LONG BURNING PIPE AND CIGARETTE TOBACCO

"Well, smoke it yourself if you want that all-fired-joy-feeling!"

Prince Albert hands out more genuine happiness each puff—via jimmy pipe or makin's cigarette—finer flavor each puff and fresher fragrance each puff than you ever did dream would fall to your lot. The patented process *fixes that*—and cuts out bite and parch! From dawn's early light until turn-in-time you can bang away, *man-like,* because there isn't any flare-back in

PRINCE ALBERT

the national joy smoke

Don't you linger-longer-than-a-mighty-short-time about what you're going to do about this pipe-packing and makin's-material question. Because, men, you're losing fascinating fun and a bunch of contentment that will slide-into-your-system when you greet P. A. face-to-face!

Now, you set-sails and steer right to Port P. A. and swing swift and true with your party-pipe or some "papers" and it'll be fair weather *for yours,* coming and going! Go to the toppy red bag, at a nickel; or land on the tidy red tin for a dime; or pick the handsome pound and half-pound tin humidors. But of all the P. A. packages, you'll find that classy crystal-glass pound humidor what you *need most!* The sponge in the top keeps the friendly tobacco in such bang-up trim!

R. J. REYNOLDS TOBACCO CO., Winston-Salem, N. C.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Aviation

AIRCRAFT.—G. A. OCHISSEK and J. JAWORSKY, P. O. Box 1448, 626½ Alvarado St., Los Angeles, Cal. This invention provides carrying planes that avoid lateral slippage and automatically correct the horizontal planes thereof; provides means for automatically maintaining the line of flight, said means being manually controllable to vary the line of flight; provides means for reinforcing the levitating structure without increasing head pressure thereof; provides longitudinal stabilizing mechanism automatically operable and manually controllable; provides means for altering the line of flight in the horizontal plane, and provides a drag for arresting and banking the machine in flight.

AEROPLANE.—J. M. DEITRICH, Box 894, Tulsa, Okla. This inventor provides a device by means of which the aeroplane may be safely brought to earth in case of accident. To this end he constructs the main sustaining plane in the form of a curve and so places the various parts of the device that the weight is symmetrically disposed about the center of gravity.

Of General Interest

METER SEAL.—J. G. GORGEN, care of Mr. Bretz, 747 10th Ave., New York, N. Y. In the present patent the invention has reference to improvements in seals, and has for an object to provide an improved construction which will readily disclose the fact that the same has been tampered with when an unauthorized person attempts to open the same.

SPOOL.—C. H. FORNEY, 96 Duncan St., Jersey City, N. J. An object here is to form a spool from tubular members and a plurality of bracing members arranged therein for holding the tubular members in the form or shape of the conventional spool. Another object is to provide a substitute from the conventional solid wooden spool by forming a spool from a plurality of built-up parts.

NON-REFILLABLE BOTTLE.—C. A. FOLLY, Box 1, R. F. D. No. 2, Boonton, N. J. This invention relates particularly to what is known as a non-refillable bottle or receptacle of any kind, and has for an object to provide an improved simple and strong structure which utilizes the principle of air displacement in its construction, whereby a refilling is prevented.

MANUFACTURE OF COLOR LAKES.—A. E. GESSLER, Rosebank, S. I., N. Y. This invention consists in the production of new coloring matter lakes, valuable in consequence of their insolubility in water and oil which makes them well adapted to the manufacture of printing inks, paints and pigment colors for all purposes.

BOTTLE DRAINER.—C. H. TAYLOR, 80 Beacon St., Newburgh, N. Y. This invention has particular reference to means for supporting a milk bottle or other analogous container in an inverted position for draining after being washed and rinsed. While the support is especially designed for use in connection with milk bottles, the device is not so limited in use.

SIFTER TOP.—A. HESS, 457 Broadway, New York, N. Y. The invention provides a perforated top for cans and the like and a perforated slide co-acting therewith, together with resilient means for holding the slide against the top, whereby when the slide is moved to one position the aperture therein will register with the apertures in the top, and when moved to another position will be out of registry so as to close the top.

ARTIFICIAL SAUSAGE SKIN.—C. LANGE, Friedland, Silesia, Prussia, Germany. The invention relates to an artificial skin for sausages, which is intended to serve as a substitute for the intestines otherwise used in making sausages and similar preserves. Many difficulties in the use of former substances are completely avoided according to the present invention by the skin of the sausage being made of the fibers of animal sinews or the like.

HORSE COLLAR.—F. SCHOCK, Montello, Nev. The improvement provides a collar capable of adjustment to fit necks of different size, and wherein the collar is composed of a rigid frame, having a cushion-engaging surface and provided with an inflatable inner lining, and permitting to dispense with the use of hames.

Hardware and Tools

HAMMER HEAD.—L. R. G. JOHNSON, Miakka, Fla. This invention comprises a hammer head divided on a central longitudinal line, each separable part or section having a semi-cylindrical, screw threaded terminal, and the face or striking member having a threaded socket adapted to receive the complete, threaded cylindrical tenon formed by such terminals.

ALINING PLATE FOR FLOOR HINGES.—O. KATZENBERGER, care of Lawson Mfg. Co., 215 W. Huron St., Chicago, Ill. This invention relates to alining plates and particularly to an improved and simplified construction which may be readily adjusted at any time. Another object is to provide a simple, strong alining plate which may be adjusted after the door hinges and alining plate have all been placed in position.

NUT WRENCH.—W. L. BESSOLO, 12104 Euclid Ave., Cleveland, Ohio. The invention is an improvement in that type of nut wrenches in which both jaws are adapted to move toward and from each other to adapt them for gripping and releasing a nut or other object, and in which the jaws are moved toward each other when a pull is applied to the lever handle.

WRENCH.—M. V. SEIVERT. Address E. A. Berke, Attorney, Elkton, S. D. The wrench is for use especially in restricted places, wherein the nut or bolt to be released can be engaged radially or longitudinally, and wherein a chuck is mounted to rotate in a handle and is provided with mechanism for preventing reverse rotation in either direction, wherein the chuck is removable from the handle and reversible, and wherein releasable mechanism is provided, releasable with mechanism for releasing the chuck to permit it to move out of the opening of the handle.

DEVICE FOR USE IN WIPING PIPE JOINTS.—R. E. HIGBEE, Windsor, Mo. In this case the invention is an improved device for holding a nipple or ferrule in due position on the end of a lead pipe while the joint is being wiped. The device is in effect conical and thus adapted to enter the mouths of nipples of different diameters.

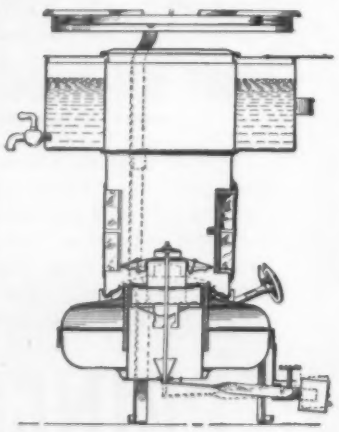
CLAMP ATTACHMENT FOR WRENCHES.—E. HAKEY, Box 327, Swanton, Vermont. This invention relates more particularly to a combination wrench and clamp. It provides a wrench with a clamp mechanism carried by the movable jaw of the wrench and capable of adjustment relatively to the fixed wrench jaw.

DOOR HOLDER.—E. FRANCKAERTS, 396 Waller St., San Francisco, Cal. This invention is an improvement upon the door holder for which Mr. Franckaerts received Letters Patent No. 1,100,475. In that case the holder could be used only on the outside of the door, but by the simple means he has effected, the shoe or stop member proper is reversible, and the holder is adapted for use on either the inside or outside of the door.

Heating and Lighting

OIL BURNER TORCH.—F. M. KELLERMANN, 41 Simonson Place, Port Richmond, S. I., N. Y. The burner is for use on mechanics' torches or analogous purposes, the structure being such as to adapt it to the use of liquid fuel combined with air or the like. The greatest efficiency of heat is obtained in connection either with a hand torch or for use in connection with a power operated apparatus.

LAMP.—P. MALCAMP, care of Mr. Charbonnet, druggist, corner Derbigney and Frenchman Sts., New Orleans, La. Mr. Malcamp's invention is an improvement in lamps, and has for its object the provision of a lamp adapted for burning liquid fuel, as for instance, kerosene, and so arranged that it may be used for lighting, heating and cooking, and wherein means is provided for regulating the combustion of the fuel to produce the results desired.



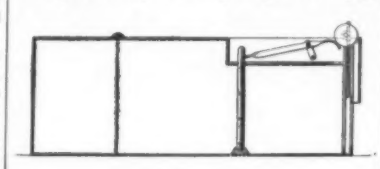
LAMP.

ATTACHMENT FOR A BURNER.—D. DAVIS, 413 Broadway, New York, N. Y. This invention provides an arrangement of lamp attachment for a heating burner which burns kerosene, whereby the same gas generator may be used as a generator for the heating burner or as a generator for the attachment which forms an auxiliary burner.

WATER HEATER.—S. C. WELLS, 461 W. 159th St., New York, N. Y. This heater is more especially designed as an attachment to a steam generator, such as is used in apartment houses, hotels and like buildings for furnishing steam to radiators to the various rooms for heating purposes, and arranged to dispense with separate water heaters for supplying the tenants with hot water.

Machines and Mechanical Devices

TRAP.—A. C. GRIFFING, Baskin, La. The present invention relates to animal traps, and more particularly to a trap adapted to engage the animal without injury to the same. The primary object of the invention is to provide a trap consisting of a trip mechanism of novel construction operated by the entry of the animal into the trap to close the entrance thereto and prevent escape therefrom.



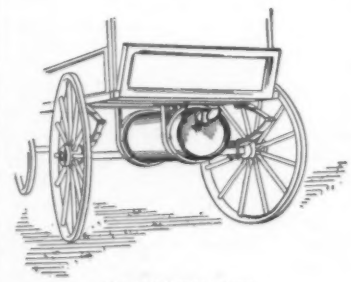
ANIMAL TRAP.

Musical Devices

COUPLER FOR PIANOS AND PLAYER PIANOS.—J. C. MOORE, and E. L. WINSTON, Address R. L. Wilhite, Rushville, Neb. The object is to connect any sounding device with another, notably, however, to connect a treble sounding device with another treble sounding device one or more octaves higher or lower and connecting a sounding device in the bass with a sounding device an octave higher or lower, so that when any one sounding device is actuated either by pressing a key or uncovering a hole in the tracker board then the coupled-up sounding device is instantly actuated with the original sounding device.

Pertaining to Vehicles

OIL DELIVERY TANK.—T. W. SKELTON, 616 Kalamazoo St., Lansing, Mich. The invention relates to an improvement in oil delivery tanks, and one of the principal objects of the invention is to provide an oil tank which may be suspended beneath a delivery wagon and from which oil may be readily dispensed to customers without danger of leakage, and without danger of odor of the oil permeating the groceries or other articles carried by the wagon.

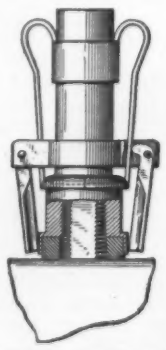


OIL DELIVERY TANK.

CHECKING DEVICE FOR RUNAWAYS.—B. GOTLIEB, 504 Courtland Ave., Bronx, N. Y., N. Y. This inventor provides a device for runaway horses and other domestic animals, and arranged to enable a rider or driver to readily check the animal by depriving it of straight ahead vision, and to allow of accomplishing the same result in case a driver has temporarily left the vehicle and the animal imparts movement to the vehicle to which it is hitched.

CARBURETER.—J. O. BLOMQUIST. Address Maxin Mfg. Co., Inc., Box 210, Beverly Farms, Mass. This invention is an improvement in carbureters, and its object is to provide a carbureter adapted to motor vehicles of every character, wherein the flow of fuel from the fuel chamber to the mixing chamber is directly controlled by the throttle valve.

DUST CAP FOR TIRE WHEELS.—HOSEA A. MASON, Taunton, Mass. The dust cap for tire valves may be instantly removed from the valve without the necessity of unscrewing. The cap is constructed with a split nut, the parts of which have recesses for receiving a washer on the valve, these split nut parts being held away from each other by springs and which are moved into engagement with the valve by cams provided for this purpose.



DUST CAP FOR TIRE WHEELS.

RUNNING BOARD SEAT FOR AUTOMOBILES.—W. F. HUSCHLE, Jr., 241 Hillside Ave., Jamaica, L. I., N. Y., N. Y. This invention provides a seat which is incorporated with a running board so that the seat will be located outside the body of the car and not interfere with the comfort of those occupying the regular seats, the auxiliary seat being of such a nature that when it is not in use it is folded down and forms part of the running board.

RESILIENT WHEEL.—J. F. NETTLE, P. O. Box 1057, Butte, Mont. This improvement provides a structure which will give a proper resilient or cushioned effect while in use. It provides a wheel with a plurality of independent spring-pressed contact members which may be independently depressed when striking an observation so as to give substantially the same effect as a pneumatic tire.

VEHICLE WHEEL.—N. CORNFIELD, 2 Columbus Circle, New York, N. Y. This inventor seeks to improve the general efficiency of road vehicle wheels by connecting together a number of separate improvements for the purpose of introducing a maximum of strength and flexibility, and a minimum of weight, together with positiveness of action and general reliability.

PEDAL SWITCH.—W. S. WILLIS, 347 W. 14th St., New York, N. Y. This invention has reference to improvements in signal devices for automobiles, and has for an object the provision of an improved arrangement wherein signal lights will be lighted according to the movement, and also the proposed movement of the automobile.

Pertaining to Warfare

ARTILLERY PROJECTILE.—EMILE RIMAILHO, 98 Rue de la Victoire, Paris, France. This invention relates to improvements in artillery projectiles or shells having an internal bursting charge preferably centrally located. It provides for arranging shrapnel balls around the outside of the shell proper and enclosed by rings which serve as devices for hooping the body of the shell, for retaining the balls which have a tendency to fly out by centrifugal action, and as members designed to be broken up into projectiles which will unite with the balls proper and with the fragments of the walls of the shell proper. The bursting charge explosion is opposed to the desired degree so as to enable the explosion to impart greatest possible velocity to the balls and fragments.

Designs

DESIGN FOR A HAND BAG OR SIMILAR ARTICLE.—H. MARGOLIN, 583 Broadway, New York, N. Y. In this case an ornamental design is shown of a hand bag in a perspective view.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—G. A. KELCH, care of American Chasing and Modeling Co., 145 E. 23rd St., New York, N. Y. The face view in this ornamental design represents an eagle spread with unfurled wings across an anchor. A wreath, tablet, rope and scroll add to the attractive appearance of the design.

DESIGN FOR A TIRE.—H. W. LAYMANN, 114 Flood Ave., Portland, Ore. In this ornamental design for a tire, a part of the tire is shown in a plan view and a side elevation is given of the first named view.

DESIGN FOR A BADGE.—SALLY C. KULL, Far Hills, N. J. This ornamental design for a badge takes the form of the United States flag unfurled, with a dove of peace spread across the stars and the word PEACE along the stripes.

DESIGN FOR A WINDOW TRIMMER'S HAMMER.—J. M. WALTERS, Box 15, Los Angeles, Cal. This design shows a hexagonal head having parallel annular grooves adjacent to the handle, dividing the head into three sections the faces of which present aligned panels. A tack lifting slot is near the handle's end.

DESIGN FOR A MEDICINE SPOON SUPPORTER.—L. S. NIPER, 290 Park Place, Brooklyn, N. Y., N. Y. In this ornamental design the supporter is a flat body elevated at one end where grooves provide for holding the handles of two spoons, the bowls of the spoons having depressions to exactly fit the bowls, the spoons being supported so as to be perfectly level to hold liquid or solid material.

DESIGN FOR AN ALTAR.—G. RATHNER. Address E. R. Kleemichen, 753 Atlantic St., Stamford, Conn. At the base of the altar are two steps of different size. The altar body is surmounted by an elevated structure of pleasing ornamental design, the top of which has three peaks, the center and highest being tipped with a cross.

DESIGN FOR A COMBINATION COAL AND GAS RANGE.—W. M. SEYMOUR, 105 E. 29th St., New York, N. Y. In this design for a combination coal and gas range the structure presents an exceedingly attractive article of fine proportions and ornamental features.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

LEGAL NOTICES

OVER 70 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

INVENTORS are invited to communicate with **Munn & Co., 233 Broadway, New York,** or **625 F Street, Washington, D. C.,** in regard to securing valid patent protection for their **Inventions. Trade-Marks** and **Copyrights** registered. **Design Patents** and **Foreign Patents** secured.

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our **Hand-Book** on Patents will be sent free on request.

Ours is the **Oldest** agency for securing patents; it was established over seventy years ago.

All patents secured through us are described without cost to patentee in the **Scientific American.**

MUNN & CO.
233 Broadway Woolworth Building **New York**
Branch Office: 625 F Street, Washington, D. C.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

BUSINESS OPPORTUNITIES

DO YOU NEED DROP FORGINGS? We can make them immediately. Large and small hammers. Some time open in November. Die sinking separately if desired. Six vertical spindles. Prompt service. C. Groos, Racine, Wis.

DEVELOPMENT WORK in machinery, methods of manufacture, inventions and patents. Reports on commercial values of inventions, patents and investments founded thereon. Term service in watching and reporting development in certain lines of manufacturing. William E. Williams, Consulting Engineer and Expert in Patent Causes, 28 East Jackson Blvd., Chicago.

ASTRONOMICAL PLANISPHERE

Can you name the stars? If not why not. The "Planisphere", a device whereby you can determine 100 bright stars and the various constellations. You move two strings and the Planisphere does the rest. Gives you the position of the stars every hour of the night. Positively guaranteed. Price $1.00. "The Planisphere", P. O. Box 63, Bethlehem, Penna.

PATENT FOR SALE

ROLLER WASHER, practical and inexpensive, to be used in connection with a washboard. Can be manufactured out of wood or metal. For further information address Elmer Horner, R. F. D. No. 2, Princess Anne, Md.

STAMPS

FREE—5 different Nyassa (camels, giraffes), or different Japanese, China, or 1916 Hungarian War Stamp. Big price list. Monthly bargain list. $2.00 premium coupon, etc., for 2c postage. If you collect, write us. 17 years in business. W. C. Phillips & Co., Glastonbury, Conn.

FOREMAN WANTED

FOR CORE ROOM who is familiar with the making of cores for both iron and brass work of medium size. State experience and wages wanted. Must be strictly temperate and capable of handling about ten men and twelve girl coremakers. Address Foreman, Box 773, New York City.

FOR SALE—PACKARD AUTOMOBILE

THE OWNER OF A 2-38 PACKARD CAR purchased in April, 1914, would like to dispose of same. Price asked is very moderate. This car has been used only in the summer months and has covered a limited mileage. It is in excellent condition and may be inspected at the Packard Motor Car Company, Broad and Kinney Streets, Newark, N. J. Price may be obtained from the Company provided the name of this paper is mentioned.

LEARN TO BE A WATCHMAKER
Bradley Polytechnic Institute—Horological Department

Formerly Parsons Horological Institute

Peoria, Illinois
Largest and Best Watch School in America
(This entire building used exclusively for this work)

We teach Watch Work, Jewelry, Engraving, Clock Work, Optics. Tuition reasonable. Board and rooms near school at moderate rates. Send for Catalog of Information.

COMFORT SELF-HEATING IRON

Two Points.

Both ends are Front Ends; Costs ½ ct. per hour to operate. Burns 5 hours on one filling of gasoline. Lights in 30 seconds. The heat can be regulated to any degree and maintained to suit work in hand. Saves its cost in a few months—saves thousands of steps and eliminates discomfort. No more hot stoves necessary. The Comfort is entirely portable and will operate outdoors or indoors. Satisfaction guaranteed. Buy at local dealers or write us direct and send your dealer's name.

NATIONAL STAMPING & ELECTRIC WORKS, Dept. 54, Chicago, Ill.

Print Your Own Cards, circulars, book, paper. Press $5. Larger $18. Rotary $60. Save money. Print for others, big profit. All easy, rules sent. Write factory for catalog of presses, TYPE, cards, samples. **The Press Co. Meriden, Conn.**

NOVELTIES & PATENTED ARTICLES
MANUFACTURED BY CONTRACT. PUNCHING DIES.
LIGHT AUTOMOBILE STAMPINGS
E. KONIGSLOW STAMPING & TOOL WORKS, CLEVELAND, O.

MASON'S NEW PAT. WHIP HOIST
for Outrigger hoists. Faster than Elevators, and hoist direct from teams. Saves handling at less expense.
Manufactured by VOLNEY W. MASON & CO., Inc.
Providence, R. I., U. S. A.

BILLINGS & SPENCER TOOLS
In a tight place, the best is not too good
TRADE MARK *HARTFORD, CT.*
Wrenches
Pliers
Screw Drivers
Hammers
Ratchets
Wrench Kits
Tool Kits

Apparatus for Mechanical Administration of Anaesthetics

(Concluded from page 473)

work automatically when once adjusted. The etherometer administers the anæsthetic with mechanical regularity, which insures the patient getting a definite and uniform quantity of anæsthetic each minute or, in other words, a definite percentage of anæsthetic vapor.

A Shell With a Base-cap That Precludes Premature Explosion

(Concluded from page 469)

shell. This would tend to preclude a premature explosion of the shell in the bore of the gun. These items give a positive value to the rotating-band in all of its present functions and lend it the additional function of a gas-check between the propulsive charge and the bursting charge.

The base-cap *B*, while serving as an advantageous carrier for the rotating-band *C*, overlaps and tightly grips the body of the shell *A*. This feature prevents the slight expansion of the shell away from the plug, which sometimes happens when a slow powder is used for a bursting charge, and thus prevents the blowing out of the plug and insures fragmentation.

The fuse carrier *D*, which can be adapted to any type of base-fuse desired, is, in the Gilmartin shell, a diaphragm held stationary by a lug. Consequently, when the base-cap is backed off for purposes of inspection, the danger of igniting the bursting charge by the friction in the threads is obviated by the confinement of the powder to its chamber. We are free to admit that this type of construction would increase the cost of shells, especially in the smaller sizes. It would also necessitate a change in plant equipment, but the question may well be asked: Is it economical to maintain the present type of construction if a better is offered?

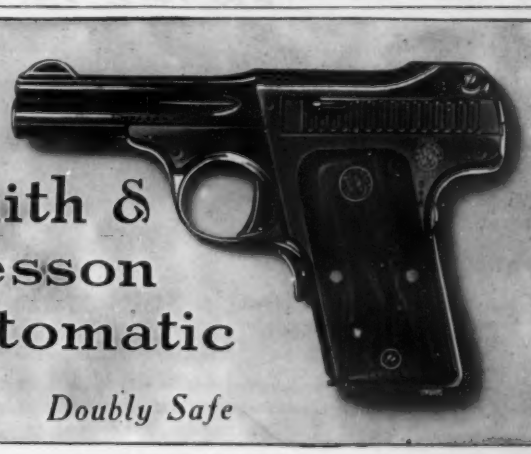
Strategic Moves of the War, November 17th, 1915

(Concluded from page 466)

Serbia's only hope lies in the Allies, and the Allies do not seem to be able to carry their part of the burden. And in spite of their brave talk, which cannot but remind one of a child whistling in the dark to keep his courage up, it is evident that they themselves fear defeat for such of their troops as are already engaged with the Bulgars. Otherwise their demand on King Constantine that if they are driven across the Greek border they will not be interned, can be explained in but one way—as a trick to break down Greek neutrality and force her to make a decision. Were Constantine to grant this demand, a situation could be created which would be without precedent in international law and totally inconsistent with all existing theories of neutrality. A neutral state would act as a harbor of refuge, within the borders of which a defeated belligerent could collect and reorganize his forces, reinforce them from his base, Saloniki, in this case, and when fully supplied, move across the border against the enemy. Neither Bulgaria nor the Kaiser could possibly submit to such a construction of neutral duties, and it would only be necessary for the French to retreat across the Greek border to cause the Central Empires to demand of Greece an immediate declaration of intentions. But, nevertheless, the fact that the demand has been made on Greece shows that the Allies do not regard their position as being any too secure. Bulgaria has apparently, now that Nish has been taken, diverted large numbers to the south to oppose the French. Indeed, it would not be a stretch of the imagination to conceive that the Bulgarian force between Nish and Vranja is content merely to hold their own, leaving it to the Teutons to compel a retreat by threatening the meagre lines of communications still existing, thus leaving a large part of the Bulgarian forces free to operate against the Allies from the south. Certain it is, the number of troops opposing the French advance has been considerably increased of late to the point where

An interview with Edison, by Wilbur J. Hall, one with Steinmetz, by Norman Draper, and an article on "Pioneers of Invention," by Alan Sullivan, are features of Collier's Electrical Number. Make the reading of them part of your participation in Electrical Prosperity Week. Get the Nov. 27th issue of

5¢ a copy
Collier's
THE NATIONAL WEEKLY
416 West 13th Street, New York City



Smith & Wesson Automatic

Doubly Safe

Are you interested

in protection to your home, *with safety* against unintended discharge?

The Smith & Wesson Automatic is Safe—it fires when you mean too, not before.

We have a booklet which tells the facts—it is free on request.

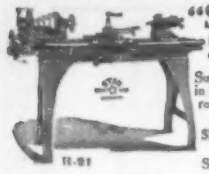
Or ask any dealer to show you the special features of the Smith & Wesson Automatic.

Send coupon for booklet

SMITH & WESSON
SPRINGFIELD MASS

FOLD, TEAR OFF, FILL IN, MAIL
No. 11-27-15
Send me book on S & W. Automatics.
Name.....
Address.....
Smith & Wesson, Springfield, Mass.

LATHES AND SMALL TOOLS



"STAR" Lathes — Large Line of Attachments — For Foot or Power

Suitable for fine accurate work in the repair shop, garage, tool room and machine shop. Send for Catalogue B

SENECA FALLS MFG. CO., 695 Water Street, Seneca Falls, N. Y., U.S.A.

The "BARNES" Positive Feed Upright Drills

10 to 50-inch Swing

Send for Drill Catalogue

W. F. & Jno. Barnes Co.

Established 1872

1999 Ruby Street, Rockford, Illinois

GROBET SWISS FILES

Are the standard of excellence in files, and have been for over 100 years. We send postpaid as an introduce 48 files especially adapted for tool makers and machinists on receipt of $5.00. This is a chance to get a set of files you'll appreciate and we'll get future orders.

MONTGOMERY & CO.

109 Fulton Street, New York City

WELL DRILLING PAYS WELL

Own a machine of your own. Cash or easy terms. Many styles and sizes for all purposes. Write for Circular.

WILLIAMS BROS., 434 W. State St., Ithaca, N.Y.

$7.50 delivered to any part of U.S.

Groos Metal Shear

Cuts ¼" Sheet Steel any width, weight 14 lbs., Steel drop forgings throughout. Vanadium Steel blades

Chicago Patented Tool Co.

1601 Owen Ave., Racine, Wis.

OF course you want your ankles to appear faultlessly neat when you dance. That's why you'll get such complete satisfaction from the PARIS GARTERS you wear.

25 and 50 cents

Find the name on the back of the shield so that you can be sure you are getting the garters most men wear.

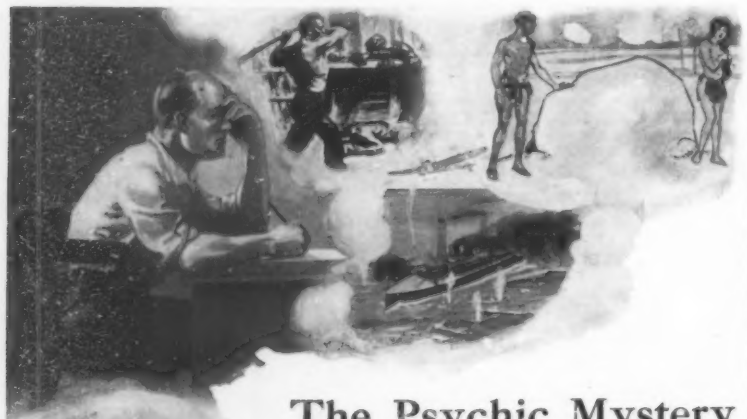
A. Stein & Co.

Makers Children's Hickory Garters

Chicago, New York

PARIS GARTERS

No metal can touch you



The Psychic Mystery of His Time

He believed that he was under the control of a spirit that had passed over the border; of a soul who, demanding earthly expression, had seized him as its instrument.

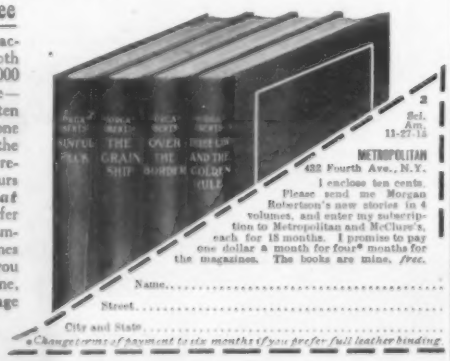
And, who can say that he was wrong?

He was without education; he had been a sailor, an odd-jobs man, a rolling stone; and when he was 36 years old there came the mysterious, irresistible impulse to write. At once he was famous. He wrote some of the most marvelous stories ever put on paper, in which the real blended with the unreal. With uncanny accuracy, he foretold the sinking of the Titanic, ten years before the ship went down, in a story that reads like a newspaper account of the actual happening. He invented the periscope, and foretold the use of the airship and submarine in modern warfare.

And though he was not educated in the regular sense, his writings are a marvel of correct English, scientific knowledge and psychic inspiration. Also, he possessed the art of telling gripping, absorbing stories. See below how you can get Free the new 4-volume edition of Morgan Robertson's Works.

How You Can Get the 4 Books Free

The 35 Morgan Robertson stories, embracing his best work, are in four handsome cloth bound volumes—1,000 pages—over 300,000 words printed in new easy-to-read type—titles stamped in gold. You send only ten cents now with the coupon. After that, one dollar a month for four months to pay for the magazines for eighteen months, at less than retail prices, and that's all! The books are yours FREE. ***If you wish to pay all at once, send only $3.75.*** If you prefer full leather binding, send $5.75. We recommend this edition to book lovers. Magazines may be sent to different addresses. If you are at present a subscriber to either magazine, your subscription will be extended. Postage extra outside of the United States.



Sel. Am. 11-27-15

METROPOLITAN 432 Fourth Ave., N.Y.

I enclose ten cents. Please send me Morgan Robertson's new stories in 4 volumes, and enter my subscription to Metropolitan and McClure's, each for 18 months. I promise to pay one dollar a month for four* months for the magazines. The books are mine. *free.*

Name.....

Street.....

City and State.....

*Change terms of payment to six months if you prefer full leather binding.

Metropolitan 433 FOURTH AVENUE NEW YORK

the French find their forward movement effectually checked. As to numbers, it is all guesswork to attempt to figure the number of Allied troops now in Serbia. Berlin states that there are, at least, 300,000—but this estimate is made for the purpose of impressing the other Balkan States with the power of the Teuton-Bulgar force. But whatever the numbers may be at present, they are constantly being augmented, and with Kitchener, who is not in India, as was first reported, in the vicinity of the Ægean, it would not be unexpected if an important transfer were made from Gallipoli. The next week will probably show much more rapid developments in the Serbian situation than have been noted since the early days of the invasion.

The Heavens in December, 1915

(*Concluded from page* 470)

brighter than Capella, and a splendid object, visible all night long.

Uranus, though technically an evening star, setting at 8:20 P.M., on the 15th, is practically unobservable. Neptune is on the western edge of Cancer, approaching opposition, and well observable telescopically.

The moon is new at 1 P.M. on the 6th, in her first quarter at 7 A.M. on the 13th, full at 8 A.M. on the 21st, and in her last quarter at the same hour on the 29th. She is nearest us on the 6th, and remotest on the 20th, and, during the month, is in conjuction with Mercury on the 6th, Venus on the 8th, Uranus on the 10th, Jupiter on the 13th, Saturn on the 22d, Neptune on the 24th, and Mars on the 26th.

The sun reaches his greatest southern declination—the winter solstice—on December 22d, at 5 P.M.

Princeton University Observatory, November 15th, 1915.

NEW BOOKS, ETC.

THE ORIGIN OF ARTILLERY. By Lieut.-Colonel Henry W. L. Hime, (Late) Royal Artillery. New York: Longmans, Green and Co., 1915. 8vo.; 231 pp.; with frontispiece. Price, $2 net.

Lieut-Colonel Hime, who already has a number of original works and translations to his credit, here tells the story of artillery. His introduction wisely explains the exact meanings of such terms as "gunpowder," "explosion," and "progressive combustion," and deals with the difficulty of reducing the poetical descriptions of old chronicles to sober actuality. The various divisions of the work treat of the origin of gunpowder, of cannon, and of ammunition, and there are sixteen tables concerning themselves with such subjects as the refining of saltpetre, the connection between size of grain, muzzle velocity and pressure, and the composition of time fuses and of signal rockets.

THE SPELL OF THE HOLY LAND. By Archie Bell. Boston: The Page Company, 1915. 8vo.; 371 pp.; illustrated. Price, $2.50 net.

The author is a newspaper reporter who admits that he cares no more for theology than for agriculture, and knows little of either, so that he may hardly be accused of religious bias. Yet his narrative is by no means lacking in spiritual atmosphere, although it is sufficiently well-balanced to find the Mosque of Omar as interesting, in its own peculiar way, as the Garden of Gethsemane. The illustrations show historic landscapes and typical interiors, not a few of them being in full color; there are several reproductions of paintings with scriptural themes, and a large map of Palestine and its environs. The prospective pilgrim will find in Mr. Bell's delineation some excellent preparatory reading.

THE FUTURE OF SOUTH AMERICA. By Roger W. Babson. Boston: Little, Brown and Company, 1915. 8vo.; 407 pp.; illustrated. Price, $2 net.

There are already, as Mr. Babson admits, many books dealing with Latin America; but since these are for the most part addressed to the tourist, the direct appeal of the present volume to commercial and industrial interests fully justifies its publication. The author's visits to, and his relations with, the countries here treated of, have been purely commercial, and the information and statistics he gives us show a systematic thoroughness of observation, and offer vital facts and very real and tangible aid to the manufacturer, shipper, or representative. Each country, from Cuba to Brazil, is given its separate chapter, and attention is called to the mistakes we have made in our trade relations with these peoples. South American investments are considered in a final chapter. Good folding maps are included, and the statistics set forth area, population, imports and exports, and financial and economic growth.

The Christmas Scribner

"When the bracken harvest's gathered and the frost is on the loam,
When the dream goes out in silence, and the ebb runs out in foam,
Mary, Mary Shepherdess, she bids the lost lambs home."

—From the poem, "Mary Shepherdess," by MARJORIE L. C. PICKTHALL.

From a drawing by Benda

"The Antwerp Road," a prose poem by HENRY VAN DYKE.

"Coming Home," by EDITH WHARTON. A war story of the American Relief Corps.

"The Very Lilac One," by MARY R. S. ANDREWS, author of "The Perfect Tribute." *Illustrated by Irma Dérèmeaux.* How a clever young woman raised the money for her wedding.

"Jeanne, the Maid," by GORDON ARTHUR SMITH. *Illustrated by Howard Giles*, one of them in color. A story of the France of to-day.

"The Medicine Ship," by JAMES B. CONNOLLY. *Illustrations by N. C. Wyeth*, one of them in color. A most absorbing and remarkable yarn of the sea.

"The First-Born," by KATHARINE HOLLAND BROWN. *Illustrated by F. C. Yohn.* A tender, beautiful story of a father's love.

"The Jade," by ABBIE CARTER GOODLOE. *Illustrated by T. K. Hanna.* A love story of the Old South.

"Her Own Sort," by CHARLES BELMONT DAVIS. A story of the movies. *Illustrated by F. R. Gruger.*

"When Payne Wrote 'Home, Sweet Home,'" by THATCHER T. P. LUQUER. *Illustrated.*

"M. le Curé's Lunch-Party," by ELIZABETH SHEPLEY SERGEANT. An experience in old Provence. *Illustrated by Thornton Oakley.*

In the Field of Art: "The Wonder of Work," by JOSEPH PENNELL.

A colored cover and beautiful pages in color.

Begin your subscription with this number. Send for a Prospectus—it will interest you.

$3.00 A YEAR

CHARLES SCRIBNER'S SONS

Cadillac
Standard of the World

A graphic survey of the motor car situation

There are two large motor car markets in America.

One of them—the largest, of course—is the market for cars selling for less than a thousand dollars.

The other is the Cadillac market.

Aside from these two great markets, there are cars below the Cadillac in price, but which sell for more than a thousand dollars.

And there are also cars selling for a price higher than the Cadillac Price.

But neither of them enjoys a volume of demand which at all compares in size with the Cadillac demand.

So, we repeat, the two large divisions in the motor car business are the low priced division and the Cadillac division.

In the one case the appeal is primarily one of price.

In the case of the Cadillac, the appeal is solely on the score of quality.

In both cases the American public has registered its verdict fairly and squarely and finally.

In the low priced field it has divided its allegiance among a number of cars.

In the search for quality, it has conferred by far its largest measure of approval upon the Cadillac.

The willingness of so many thousands of people to pay a higher price for the Cadillac must, of course, be ***founded upon reason.***

The refusal of so many other thousands to pay more for a car than the Cadillac price—notwithstanding their abundant ability to do so—must likewise be ***founded upon reason.***

In one sense, the question of price does not occur to them at all—what they want is the greater smoothness, the greater steadiness, the greater constancy and the greater comforts which the Eight-Cylinder Cadillac provides.

They want the wonderfully swift acceleration; they want the luxury of traveling practically one hundred per cent of the time on high gear.

They want the sturdiness and dependability; they want the day-in-and-day-out, year-in-and-year-out service and satisfaction which have always distinguished Cadillac cars.

They want that comprehensive efficiency which manifests itself in the Cadillac, not merely now and then, but at all speeds and under all conditions.

Every moment is a more pleasurable moment for them in the Cadillac—every hour an hour of greater ease—every mile a smoother, steadier mile.

Believing that they derive more enjoyment out of it than out of any other car, is it not perfectly logical that the Cadillac should enjoy a larger ownership than any other high grade car in the world?

Styles and Prices

Standard Seven passenger car, Five passenger Salon and Roadster, $2080. Three passenger Victoria, $2400. Four passenger Coupe $2800. Five passenger Brougham, $2950. Seven passenger Limousine, $3450. Berlin, $3600. Prices include standard equipment, F. O. B. Detroit.

Cadillac Motor Car Co. Detroit, Mich.

THE THINKER

How Much Do You Think?

"The Thinker" is the sculptor Rodin's conception of man as he looked when he began to think—*to a purpose.*

Primitive man was but a degree removed from the brute—a creature of instinct—until he began to think and devise means to ameliorate his lot.

It has taken thousands of years—no one knows how many—to produce the modern type of man who supplies his daily needs and his luxuries through the exercise of his *brain* rather than his *muscle.*

Try communing fifteen minutes a day with the greatest thinkers the world has ever produced, and you will be surprised at the effect on your mental growth. The mind, like the body, gains strength through nourishment and exercise. The best mental nourishment that could be prescribed is found in the volumes whose titles are given below, and the best exercise, thinking over the revelations they contain.

Again—some foods are nourishing but not palatable to all tastes. But the mental food we are recommending is palatable *to all tastes* because the books are interesting and entertaining—in fact, they are wonderful.

Our modern civilization, the product largely of the tremendous advances in knowledge of the last half century—the age of Darwin and his fellow scientists—is the concrete expression of the thought contained in—

The Library of the World's Greatest Scientists

DARWIN——SPENCER——HUXLEY——TYNDALL——LOMBROSO

Gives the same air of distinction and discriminating taste to the home as would a valuable painting by a world-famous artist, or a choice piece of furniture by Chippendale, Sheraton, Heppelwhite, or the other great eighteenth-century craftsmen

THE ORIGIN OF SPECIES
THE ORIGIN OF SPECIES
THE EXPRESSION OF THE EMOTIONS IN MEN AND ANIMALS
THE FEMALE OFFENDER
MAN'S PLACE IN NATURE
SOCIAL STATICS OR ORDER
FRAGMENTS OF SCIENCE AND LESSONS IN ELECTRICITY
THE WORLD'S GREATEST SCIENTISTS

When social and business acquaintances scan the contents of your bookshelves—what impression do they receive? "Show me a man's books and I'll tell you what he is," *once declared one of our big captains of industry.*

Titles of These Wonderful Volumes

Vol. I. THE ORIGIN OF SPECIES: SURVIVAL OF THE FITTEST, ETC.
By CHARLES DARWIN

Vol. II. THE ORIGIN OF SPECIES: AFFINITIES OF ORGANIC BEINGS, ETC.
By CHARLES DARWIN

Vol. III. EXPRESSIONS OF THE EMOTIONS IN MEN AND ANIMALS.
By CHARLES DARWIN
(MANY INTERESTING ILLUSTRATIONS)

Vol. IV. THE FEMALE OFFENDER: THE CRIMINAL TYPE IN WOMEN, THE SOCIAL EVIL, ETC.
By PROF. CAESAR LOMBROSO
(PROFUSELY ILLUSTRATED)

Vol. V. MAN'S PLACE IN NATURE
By THOMAS H. HUXLEY
(ILLUSTRATED)

Vol. VI. SOCIAL STATICS OR ORDER
By HERBERT SPENCER

Vol. VII. FRAGMENTS OF SCIENCE AND LESSONS IN ELECTRICITY
By JOHN TYNDALL
(ILLUSTRATED)

Prof. Francis B. Crocker, Past President of the American Institute of Electrical Engineers, has contributed a very interesting introduction to Prof. Tyndall's "Lessons in Electricity," in which he sketches the history of the science of electricity and magnetism, and the development of their practical application, from the earliest recorded dates of their discovery down to the present day.

Books That Startled the World and Agitated Society with a Revolutionary Ferment

These great scientists studied life from every angle. They will help you solve its problems. They will open your eyes to an understanding of its mysteries—*to an appreciation of its potentialities.*

No other books are so replete with ideas that can be turned to practical advantage by the unscientific reader. You *will want* to read them not once, but often, and each time you will find fresh entertainment and discover new food for thought.

The story told in the Origin of Species is as wonderful as any tale of oriental enchantment. This book revolutionized modern thought. Where formerly there was chaos of speculation and theory, it substituted a revelation of Nature's immutable laws.

We are seeing the results of the application of these laws in the physical and mental improvement of the human race. Their application to economic problems has already added untold millions to the wealth of nations.

Prof. Lombroso's Book on Criminology

As an illustration of the wide scope of this set, there is the volume on The Female Offender, by Prof. Lombroso. No more startling revelations can be found anywhere than those contained in the picture he draws of one aspect of the underworld in this book. The Social Evil is as old as creation. We find references to it in the records of the earliest civilization. The descendants of Jezebel and Messalina are to be found in every stratum of society. The lair of "The Scarlet Woman" is located in almost every community. No study of Sociology therefore is complete that does not take into account her malign influence, and the correct measures necessary to combat that influence. Prof. Lombroso's work made an epoch in criminology because of the wide scope and systematic character of his researches.

A Handsome New Edition Just Off the Press at Less Than Half Price—NOW

Notwithstanding this great reduction in price—a price absolutely unprecedented for books of this character—the books are issued in a style superior to that in which they have ever appeared before.

Each volume is 8 inches x 5¾ inches.

The binding is a rich, dark green, silk ribbed cloth, with gold paneled backs, finished with gilt tops and silk headbands.

The volumes are printed on a pure white paper in large, clear, type.

There are many illustrations in half tone which are just as interesting as the text.

MAIL COUPON TODAY

By assuming all the risk and expense in the manufacturing, we were able to make a very favorable contract with Messrs. D. Appleton & Co., the publishers of these celebrated books, for the right to print from their newest plates, a fine edition of the works of Darwin, Spencer, Huxley, Tyndall and Lombroso comprised in The Library of the World's Greatest Scientists. Conditions in the publishing world have also made it possible to secure very low figures for printing and binding on large editions that will keep the plants steadily at work on reorders. But only in case book-buyers respond quickly and thereby enable us to keep the presses busy can we undertake to maintain this price, which we reserve the right to advance without notice.

Money back if not as represented. BUT YOU MUST SEND COUPON NOW.

ATTACH COUPON AND $1.00 TO YOUR LETTERHEAD

S. A. 11-27-15

Brunswick Subscription Co., 449 Brunswick Bldg., New York City

Enclosed is $1.00, first payment on the 7-volume set of The World's Greatest Scientists, to be shipped, charges prepaid. I agree to remit $1.00 a month for six months following receipt of books, or to return them at once if not as represented, you to refund my $1.00.

Name.....

Address.....

City.....State.....